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Cold Fusion and New Energy Technology

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Prof. Robert Bush at Cal.Poly. lab

Makes John Huizenga blink...

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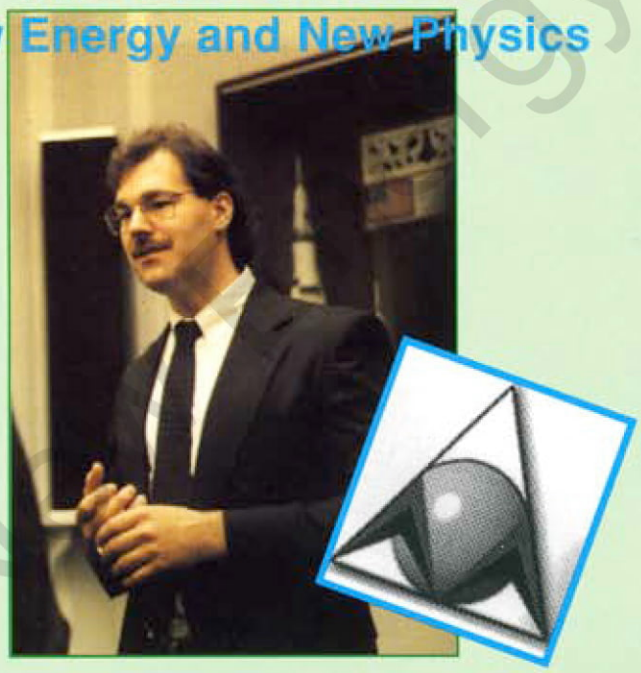
Dr. Randell Mills and BlackLight Power, Inc. ....at the Frontiers of New Energy and New Physics



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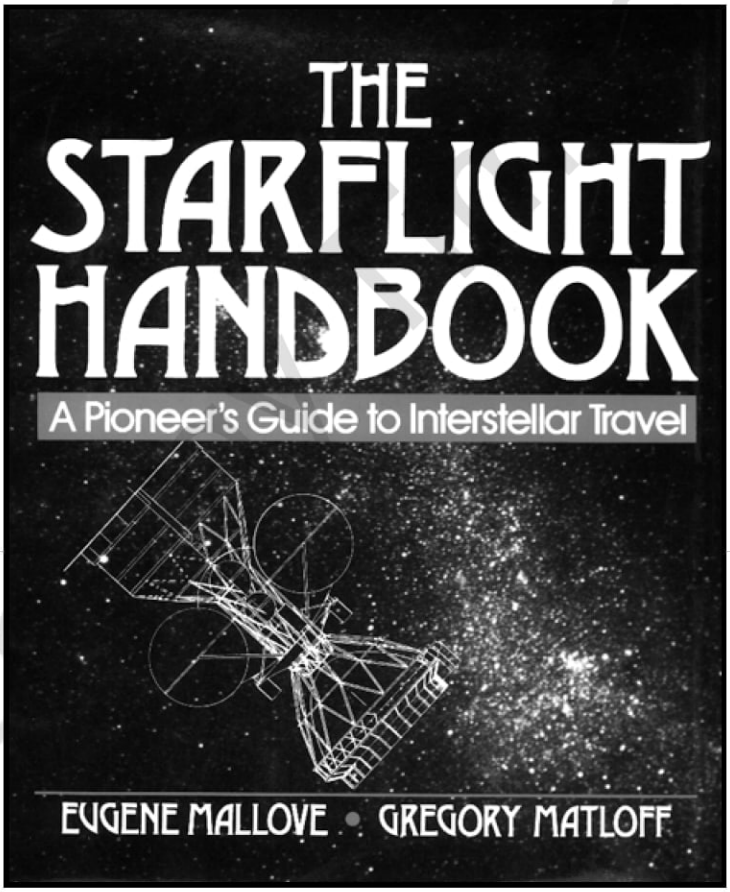

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Infinite Energy

Cold Fusion and New Energy Technology

Volume 2, No.12, Jan./Feb. 1997

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Table of Contents

Volume 2, Issue #12 January-February 1997 ***(Nominal)***

Breaking Through, Editorial — 3
Deceptive Appearances

Letters to the Editor — 5

Arthur C. Clarke on Cold Fusion in *Discover* — **7**

Cold Fusion and the Future
Jed Rothwell — 10

Ragland Triode Reactors Shipped Commercially
Eugene Mallove — 20

Dr. Randell Mills and **BlackLight Power, Inc.**
Eugene Mallove — 21

The Saint (Movie) Comes Marching In — 22

CF Cell Makes DOE's John Huizenga Blink
Dr. Robert T. Bush — 23

The CF Work of Robert Bush: An Interview — 25

Consequences of Lattice Occupational Symmetry
Dr. Robert T. Bush — 34

Calendar & ICCF-7 News — 36

BRIEFS
• ANS Meeting in June—Cold Fusion • CETI and ENECO in Patent Dispute • "No Oil" Plate • Palladium Futures, etc. — 40

"Weird Meet Again"
Susan Seddon — 43

Review of *Wizard*— Tesla Biography
Jeffery Kooistra — 44

Review of *The Gravitational Force of the Sun*
Thomas E. Phipps, Jr. — 45

Energy Gain and Nuclear Transmutation by Low Energy p and d Nuclear Reactions
Drs. H. Hora, J. Kelly, G.H. Miley — 48

Arata and Zhang—Massive Helium/Heat Production in Cold Fusion —Abstracts; Comment by *Dr. Talbot Chubb* — 53

Drs. Patterson and Cravens Receive New **U.S. Patent (#5,607,563)** on 100:1 Energy Cell — 55

Experimenter's Corner: Segner-Marinov Turbine
Stefan Marinov — 61

Charge Clusters in Operation
Hal Fox — 62

Protonic Conductors and Cold Fusion
Drs. A.L. Samgin and S.V. Vakarin — 64

Production of Elements and Plasmoids
Edward Lewis — 69

COVER Photos

(Top) Prof. Robert T. Bush in his cold fusion lab at Cal Poly (Pomona) ***(Courtesy, Dr. Robert Bush)***

DOE Cold Fusion Panel Co-Chair, Prof. John Huizenga ***(Courtesy, Univ. of Rochester)***

Dr. Randell Mills at Fusion Energy Hearing in the US House of Representatives—May 5, 1993

(Photo by Gene Mallove)

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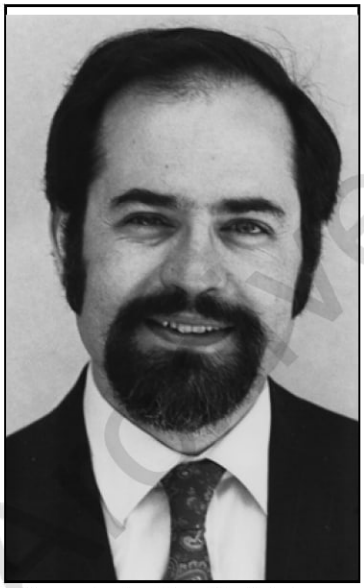
Deceptive Appearances

By Eugene F. Mallove, Sc.D.



As we enter our third volume (year) of publication, we owe our many loyal and newly aboard readers around the world a great big THANK YOU!

Infinite Energy now goes to people in three dozen countries—from Malta to Sri Lanka, from Israel (Technion) to Iran to the Ukraine. We have a difficult task: publishing quality technical papers, speculative papers, journalistic accounts of activities, and essays about the future of virtually every aspect of life— as it will be transformed in the New Energy Revolution. Jed Rothwell's piece in this issue, Part 1 of "Cold Fusion and the Future," is a bold road map of things to come. He will offer up more in issues that will be on their way.

We are ever aware that we have to provide a veritable smorgasbord of material—something to please each palate of understanding. Not everyone can deal with the most technical articles, but those who can't should be pleased to get the gist from us of what these experts are saying and doing. Each issue of *IE*, we trust, has enough content of "light stuff," editorial, and opinion, to please virtually everyone. If it doesn't, then please let us know.

Appearances are deceptive. Today the cold fusion and new energy scene might be likened to a deep, seemingly placid lake. On the surface of that water, all may appear calm to casual observers—or even to some avid readers of *Infinite Energy*. Not everyone is privileged (or *burdened*!), as are we, to observe the daily storms of activity and potentiality in business, experiments, and technology, so they may not grasp all that is going on between issues of *IE*— not to mention the material, some of it tantalizing, for which we at the moment simply have no space or time to devote.

Yes, and we probably have a greater knowledge of what the opponents of cold fusion are up to than anyone on earth! We could do without that distraction, but it is well to keep in mind that this technology and science are *not* being developed in a sterile vacuum. There is *passion* involved on every front. This is a human revolution, which manifests the strengths and frailties of all the participants. As our fine contributor this issue, Dr. Robert Bush of Cal Poly, Pomona, so rightly observed: ***"A revolution is only that if there are defenders of the status quo as well as revolutionaries."***

A more apt metaphor of the CF/NE and transmutation scene might be a vast ocean, with localized storms visible only to satellites. This ocean is about to unleash a historic tidal wave that could inundate virtually every continent. The titanic earthquake in science that will generate that tidal wave of human activity—an unprecedented technological revolution—may well strike before the year 2000, but it *could happen any day....*

The vast continent of Fossil FuelFuelFission (FFF) will eventually be buried by the force of the wave deeper than the mythic (or was it real?) Atlantis. The continent of Academic Self-Satisfaction (the acronym just happens to be ASS) may engage in a last-ditch effort to save its image of Custodian of Truth, but this will be a very difficult trick to pull off in view of its perfidies throughout this revolution. That land will drown— to be recast, we hope, in a kinder and gentler form.

What will happen to MediaLand (or Mediocracy, with an "o"), as some would like to call it)? It will be delivered such a dramatically chastening lesson in how out-to-lunch it has been, it is difficult to fathom in what form it will recover. Many will offer mea culpae, such as that American reporter did many years later, who totally missed the implications of what the Wright brothers had accomplished in their early years at the turn of the century, right before his face. He offered something like: "When it's all said and done, in truth, we were just dumb."

What of the continent of HF, "Hot Fusion"? Phew to Phewsion! It will become TheFew-Shunned. Enough of word play... The TFTR tokamak reactor at Princeton has finally expired, and is now a radioactive hulk. But as usual for this land, the inhabitants are scurrying about looking for new ways to milk governments in this now preposterous charade. Hot fusion reactors will *never* be practical for delivering domestic power. Everyone knows that but those who are on the HF dole. In the US, and later elsewhere, we'll just have to find a way to pull the plug for good on the "reactor technology," while saving the valid plasma science.

Some of the signs to suggest that appearances of calm are deceptive:

• In the first week of June in Orlando, Florida, the American Nuclear Society will be meeting. Featured will be a panel of cold fusion researchers (see page 40). More important, it is possible that Clean Energy Technologies, Inc. (CETI) will deliver a one-two punch to The Status Quo Paradigm — or maybe it will be just a single punch. The company is known to have an operating water heating unit that has delivered hundreds of watts excess power continuously for *months*. This may be shown at that meeting, but for various unfathomable reasons, it may not be shown. The other thing that might happen in combination with the water heater demo is the electrolytic radiation reduction, *i.e. a public demonstration of the efficacy of alchemy*— albeit with the most modern an convincing scientific instrumentation that can be brought to bear. The scene in Orlando, if either or both of those punches are delivered, *is not to be missed!* Oh, the naysayers will have their crackpot explanations of why it's still all baloney. Worse, if the punches are not delivered, they'll make up even crazier stories about fraud and avarice.

• There are now active competitors to public demonstrations by CETI. BlackLight Power, Inc. has a continuous "demonstration" going on right now in cyberspace (see story on page 21). This company means business, quite literally. It has many allies and supporters. With the heightened cyberspace profile, it could get a lot more support. It is out to build power plants, Big Ones. Of course, we wish it would have some actual itty-bitty demonstration units out there *right now.* That is being planned: at least in support of the company's scientific work —the "classical quantum mechanics" of Dr. Randell L. Mills. So confident is the company of its work that it has "bet the company" with a fantastic name change— from HydroCatalysis Power Corp., to BlackLight Power, Inc. This designates the ultraviolet emissions that happen in the hydrino formation process. If hydrogen atoms are really shrinking to sub-ground states, then clearly Physics (or is it Fizzix?) is in for one hell of a massive course correction! Oh, God, we can pray for such a cosmic joke on the continent of the "ASS"!

• The cold fusion helium production results of Arata and Zhang profiled in this issue are stunning (page 53). There is

C ontinued on page 4

NOT FOR SALE Free Energy

much helium-3 evolved, as well as helium-4. This is one of the most convincing proofs of literally heat-producing cold fusion of hydrogen. It is straight alchemy. If ever there were a loaded gun aimed at the scientific establishment's head, this is it.

• Evan Ragland has shipped us several triode configuration cold fusion cells— a first for interstate and international commerce (see page 20). We are beginning tests of these cells in our laboratories both in New Hampshire and in the UK. If these work, as advertised—reproducibly and robustly— we will have a perfect opportunity, working with Ragland's company, to do what we have wanted to do all along: Get into the hands of *everyone who needs to explore the astonishing Pons-Fleischmann phenomena* the proper research tools to observe the effect without a long learning curve. We'll leave it to others—who are working on it right now— the problem—of scale-up of the Ragland cells to multi-kilowatt units, but we'll gladly work with them in that effort too. **But it is abundantly clear to us that the widespread dissemination of demonstration units is absolutely essential to the triumph of the coming energy revolution.** *Nothing* has slowed down that revolution more than the inability of "our side" to shove in the face of any doubter willing to look a real, working cell. By the way, the Ragland cell is not the only demonstration device we are now exploring. One way or the other, we are determined to *do it*—or to force others to *do it!*

One very good science journalist, Ira Flatow of National Public Radio, had me on his "Science Friday" program on the afternoon of April 4th—the day that *The Saint* opened in the US. For the first half-hour a hot fusion man, T. Kenneth Fowler, who has just penned a book about his years in hot fusion and about the "glorious future of hot fusion." He went on and on: "Give us more money and we will do it..." This man happened also to have been on Huizenga's "objective" (Ha!) DOE ERAB Cold Fusion Panel in 1989. Apparently, he hasn't learned anything more about cold fusion since 1989—and, he doesn't plan to. In his book, he wrote: "Though a few scientists and a coterie of other enthusiasts have continued to claim otherwise, as far as I can tell the overall conclusion that cold fusion is an illusion still prevails, though I confess I have not been motivated to pay much attention lately." (page 174, *The Fusion Quest*, Johns Hopkins Press, 1997).

After I came on and told of all the new developments that were happening with CETI, BlackLight Power, Arata's work, etc., when asked by Ira Flatow what comment he might have about cold fusion, he said, simply: "No Comment." Here is a "scientist," who thinks he can draw a conclusion about something as momentous as cold fusion even though he has not been "motivated to pay much attention lately."

Amid all this activity, what are *most* science journalists doing? But, of course, ignoring us or throwing stones. We have that supremely arrogant fellow Gary Taubes, whose comments were profiled in this space last issue. I pointed out his absurd, fallacious remarks to *The Wall Street* Journal. (On March 31, 1997 the newspaper published by rebuttal letter--see this issue of *IE*, page 43.) Now Taubes has outdone himself. In the April 1997 issue of *R&D Magazine*, Taubes is quoted by journalist David Kestenbaum in an article, itself inappropriately titled, "Cold Fusion— Science or Religion." Not a bad article, but Taubes' remark about cold fusion is "something else": "It's like with the herpes virus. It's always there. You just have to carry it around until it becomes enough of a nuisance that the immune system kicks in and crushes it. Then it goes into hiding in your spinal column or something." Nice man that Taubes! Maybe he took up biology at MIT's Knight Science Journalism Fellowship Program and is applying his new-found metaphors to his

Continued on page 9

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LETTERS TO THE EDITOR

Eugene,

I am so proud of the work you did on "The Saint." Katrina and I saw it tonight and I just had to let you know that I thought the movie was fun, exciting, and focussed on a great technology.

Thanks for keeping me on the mailing list with the Cold Fusion [*Infinite Energy*] magazine, too. Perhaps we can get together and trade notes sometime soon. (Since we are neighbors, it should be fairly easy!)

Keep up the good work. I'll look forward to seeing you around town.

Dick Swett

Editor's Note: Dick Swett, a neighbor in Bow, New Hampshire, is a former Congressman from the 2nd District, who served two terms. He and ex-Congressman Robert Walker of Pennsylvania (see IE #4, p.6) helped facilitate the introduction of alternative fusion and cold fusion testimony by Dr. Edmund Storms and Dr. Randell Mills into the nominally hot fusion House Science Committee hearings of May 5, 1993. In the U.S. Senate race with Senator Bob Smith last year, Dick Swett advocated the abandonment of the federal tokamak hot fusion program. Senator Smith, who won that race, has an outstanding advisor with a demonstrated interest in new forms of hydrogen energy. He is now following cold fusion closely, having been briefed by us. The message is clear: We here in New Hampshire—the "Live Free or Die" state— intend to play a major role in overturning the Fossil Fuel Age.—EFM

• — • — •

I'm extremely interested to learn about the developments of Bert Werjefelt and his magnetic motor developments. I spoke with him at some length early last year but haven't heard or seen any more of his work.

My interest stems from my own work over here and coming to the conclusion that the pathway to over unity has, if you like, an elastic barrier or separator. Maybe it is the boundary condition between matter and antimatter as per Dirac.

While having seen exceptionally promising results some of which have been verified by third parties we have been plagued by stability and repeatablilty. That is, we have overunity results on particular occasions at particular times with both static and dynamic machines however when we have attempted to repeat the results with exactly the same equipment they have turned out completely different. At first we questioned whether we were "seeing things" or "going bonkers" but after exhaustive repetition over a period of 18 months I have come to the conclusion that we can distort this "boundary condition" and obtain excess energy for short or specific periods of time, but the laws of its existence cause it to very quickly return to its "rest" state. In thinking about this it all seems quite reasonable because if that boundary didn't exist there would be overunity machines all over the place!!

I feel other people may have had similar experiences which I'd be keen to hear about. I recall Hal Putoff saying this of some of his experimentation.

We need to find a way to cause a permanent distortion with say magnetic materials or the like. Anyway I be very keen to hear your thoughts or experience on this and any news of Bert.

Ashley Gray
Eastbourne Wellington
New Zealand

This is an excellent summary of where things stand with allegedly O/U magnetic motors. There appears to be some significant phenomenon that some careful investigators are seeing. As for our good friend, engineer Bert Werjefelt, his aviation safety equipment business in Hawaii is doing so well, he has not had time to properly re-engage his work with over-unity magnetic motors, but we expect to hear from him, from Galtech, and from others before too long.—EFM

• — • — •

Surfing the web, I stumbled over your very interesting pages. Is this really, REALLY the state of technology at this time? If it is, WHY (for crying out loud) is this NOT all over the newspapers in the entire civilized world? It would be an affront and insult to the intelligence of the entire human race if someone (or some organization) is holding back these incredibly important informations and discoveries... I did not hear ANYTHING about this anywhere... I for one find this unbelieveable important. Do you have any more information about this?

Andre La Pierre

Cold fusion is NOT over all the newspapers due to the appalling, sheep-like pack-mentality of science journalists in general. The US Department of Energy and its lackies in academia, who believed the outrageously biased anti-cold fusion report of Huizenga and his cronies in 1989, are holding the field back. Yes, this is an "affront and insult to the intelligence of the entire human race." But it is also true that this field is populated by many with serious "Own Worst Enemy" (OWE) syndrome, which has given free reign to the opponents of cold fusion.—EFM

• — • — •

I promise you I will have a cold fusion story by Monday or Tuesday, if not earlier. This [*Infinite Energy*] is such a stunning magazine — the more I read, the more I learn. It amazes me how—again and again — I learn how close-minded I am. That may seem funny, but there are many stories I laugh at until I discover hard evidence to back it up. Cold fusion is just one example (though I never laughed at this one.) A million thanks (which will be even cheaper when you dudes commercialize your works.)

I am disturbed by the upbeat tone of your magazine. Quite simply, you are raining on my gloom parade, and I have way too much invested in depression for your ideas to become successful. It's kind of scary.

Robert Sterling
Robalini@aol.com
Konformist Magazine

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Editor's Note: Mr. Sterling did write an excellent review of the cold fusion situation He broadcast it widely via his electronic Konformist Magazine, which deals with various conspiracy theories (the JFK assassination, etc.)—which are ordinarily not of much interest to us at IE. We must admit, however, that the "conspiracy"" against cold fusion is one of the most remarkable affronts to logic and decency in scientific history. Fortunately, the war against cold fusion will be ended decisively with the advent of commercial products, since the opponents have proved themselves incapable of accepting the data that they originally demanded. They do not understand the most fundamental concept in science: the primacy of new data over established theory.—EFM

• — • — •

I just wanted to say thanks for your work on *THE SAINT*. I thought it was a great movie and should be very helpful for generating awareness in the general public to show that Cold Fusion Lives!

I also enjoy and appreciate the continued and expanding coverage of AquaFuel and COH_2. The article "Strange-Particle Catalysis in the Production of COH_2 Gas or Iron" (*IE* #11) by Dr. Joseph L. McKibben was particularly fascinating.

Rob Jaeger
BP Valve Technology
Brandon, Florida

• — • — •

My subscription renewal for your excellent magazine is enclosed.

You seem to be asking some rather politically incorrect questions, which perhaps could be summed up as: "Is the science establishment telling the truth, the whole truth and nothing but the truth?" It seems you have concluded the answer is no, by actually studying the evidence.

I would suggest that the word "science" in the above question could be replaced with "history" or "economics," and perhaps other words, and the same answer would be valid. Identical tactics of ridicule, abuse, threats, biassed reporting and worse are used against holders of unorthodox views in these fields as well (1,2), in other words anything designed to deflect attention away from any proper investigation.

Hopefully there will soon be overwhelming evidence for new energy technology, and its suppressors will be defeated. Meanwhile I commend your occasional exposure of their dishonest methods.

Paul J.Brook
Consulting Engineer
Wellington, New Zealand

1. Jackson: "The Case for David Irving," Veritas, P.O.Box 42, Cranbrook, WA 6321, Australia.

2. Soddy: "Wealth, Virtual Wealth and Debt", also available from Veritas. Authored by the Nobel Laureate in Chemistry Professor Sir Frederick Soddy F.R.S.

• — • — •

The other day a technician at the factory asked me, "Do you know what cold fusion is?" I said, "Boy, do I ever!"—and gave him a quick snapshot. He said he had read about it in the May 1997 *Discover* magazine interview with Arthur C. Clarke. Today he showed up with the seven-page printout of your Internet printing, *"Questions and Answers"* about cold fusion. The whole plant has been buzzing about this. I have never seen such a widespread interest as in the last several months. My boss, the V.P. of R&D, has your printout and can't wait ot read it at home. A.C. Clarke's predictions are rarely wrong and I think we are about to see the tide turn.

Chuck Bennett
Sacramento, California

• — • — •

From D_W Energy Research:

Thank you for your continued interest in our Biomass Gasification process.

I am responding to some misinformation contained in William Richardson's letter printed in *IE* #11. On page 40 of that issue, Mr. Richardson states, *"In a letter to me, Mr. Dammann and Mr. Wallman complained of engine damage while running underload on their gas. A gas analysis of the product will, no doubt, include large amounts of acetylene."*

Neither I nor my colleague, Wil Dammann, have ever written a letter to Mr. Richardson. In fact Mr. Dammann has never had any contact with Mr. Richardson, whatsoever. Also, we have never had any engine damage while using COH_2 in an engine.

I believe that Mr. Richardson has misstated some information I wrote to someone else, with which he has had contact. I wrote a letter to Mr. Rick Johansen (Sept. 1996), who represented himself as a licensee of Mr. Richardson's patent. In the letter, I supplied Mr. Johansen a redacted copy of a paper from the Solar Energy Research Institute (SERI), [SERI had done a lot of hydrogen research and is now part of the National Renewable Energy Laboratory]. The paper contained information on testing of reformed methanol (COH_2) and anomalous combustion in a 4-cylinder Chevrolet car under test. The information was sent to Mr. Johansen to initiate a discussion of possible exchange of development information with respect to carbon-arc gasification of water. Mr. Johansen never responded to the letter.

My colleague, Wil Dammann, and I have no association with Mr. Richardson, Mr. Johansen, AquaFuel USA, or Richardson Energy, Inc.

With respect to Mr. Richardson's contention of *"large amounts of acetylene"* in Carbohydrogen™ gas (COH_2), analysis has never shown the presence of any acetylene in the gas.

Mr. Richardson's letter in *IE*#11 shows a unique perspective of carbon-arc gasification, which I do not share.

W. David Wallman
DW Energy Research, LLC
Colorado Springs. CO 80919

• — • — •

FROM:

SEARCH: UNH Seminars for Advanced High School Students

March 27, 1997

Dear Dr. Mallove:

Your session [at the University of New Hampshire] on the *Revolution in Cold Fusion* was fascinating yesterday. Without a doubt, all of us, students and adults, learned a tremendous amount about a subject we knew very little about prior to your presentation. You were animated, energetic, passionate, and humorous and the students picked up on your enthusiasm for the subject. I was so pleased with their response and questions at the end because, quite honestly, many of them had voiced their reluctance to attend yesterday's session and had sadly prejudged it as "boring." However, the students rated the presentation very highly, and continued with lively discussions in their smaller groups. I would like to quote directly from the students, who were responding to an evaluation question: What aspects of the program, if any, did you find especially interesting?

"That more power could possibly be produced from a very small amount of energy."

"The speaker honestly cared about the topic and put emotion into it."

"Interesting, controversial topic, a lively speaker who believes in what he's talking about."

"It is quite amazing to see new technology arising in our time and it is also discouraging to see the opposition it meets with."

"Great speaker. He had lots of energy!"

"I enjoyed the fact that the speaker presented so much information in the hour time period."

"The chance for worldwide change."

"Everything, I found Dr. Mallove had to say was very interesting. He had such passion for the topic, I could feel his energy!"

The quotes go on and on from the students. I appreciate so much the time and the energy you put into yesterday's presentation, and obviously, so did the

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"3001" author and *Infinite Energy* friend, Arthur C. Clarke

works with his tiny "ghost writer" in his study in Sri Lanka

Excerpt from his comments to *Discover* Magazine May 1997:

"I've written dozens of books on the subject [space travel] and I'm sick and tired of talking about it. I've nothing new to add, except ***I think more and more that the new space age, and the new everything age, is linked more and more to the new energy revolution...***For one thing there is this so-called cold fusion. Which is neither cold nor fusion. Very few Americans seem to know what is happening, which is incredible. It's all over the world, except the United States. Thre are hundreds of laboratories doing it, they've got patents all over the place. The prototypes are on sale now.....there are so many vested interests. There are the hot fusion boys. All the rocket engineers will be out of jobs, and a lot of the poor guys are already. I don't like to guess at a scenario, but I would say that before the end of this decade, the hand waving will be over and people will accept that this energy exists, whatever it is, and there may actually be several different varieties. A lot of heads will roll at the U.S. Department of Energy and elsewhere."

students. We would love to have you speak again to Project SEARCH in a few years. Best of luck to your tremendous efforts in the area of cold fusion.

Cindy Schram
Director, Project SEARCH
The University of New Hampshire
Durham, New Hampshire

It is always a pleasure to have the opportunity to turn young minds on to the infinite possibilities now emerging. Bless them! They do not have the prejudices of some of their elders.—EFM

•—•—•

Response to "Jonah" —who sent an e-mail in response to our WWW site:

Dear Friend,

You wrote: "I heard that cold fusion was already proven."

Yes, it has been.

"The only drawback is that the oil and automobile companies supposedly have their own little 'mafias' and the release of information would be stopped by these groups."

No, they do not have the power to stop this inevitable technology. But the US DOE and the skeptical academic scientists have done a pretty good job in slowing it down!

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"Heads will roll....." —*A.C.C.*

"Correct me if I am wrong, but wouldn't the development of cold fusion totally crush oil companies like Exxon, Texaco, and Chevron?"

Yes. Too bad, isn't it! :) — EFM
Gene Mallove

Bulk Copies of *Infinite Energy* Are Available.

New Energy Times Archive

A *must read* book—Order your copy today from Cold Fusion Technology, Inc. !

Newton versus Einstein, by Peter Graneau and Neal Graneau. Carlton Press, 1993 Hardcover. 219 pages, $14.95. ISBN 0-8062-4514-X

NEW TECHNOLOGY!

NEWTON versus EINSTEIN is not merely a critique of contemporary physics. Nor is it just an outline of the clash of philosophies. It points the way to new technologies from space accelerators to high-current switches and improved metal refining. Most exciting is the discovery of how to gain solar energy from ordinary water via the release of intermolecular bonding energy, as recently explained in *Infinite Energy* (Issue #10) and featured in a forthcoming BBC-TV program. It could become as important as the discovery of nuclear energy, yet be benign to man.

Praise for Newton versus Einstein

Inertia is a much-discussed topic. The Graneaus give a beautiful account in which they relate theories of inertia back to those of Mach at the beginning of the century. They view inertia as the result of the gravitational interaction of all particles in the universe on the body in question, instantaneous transfer making even distant galaxies a part of the interaction .

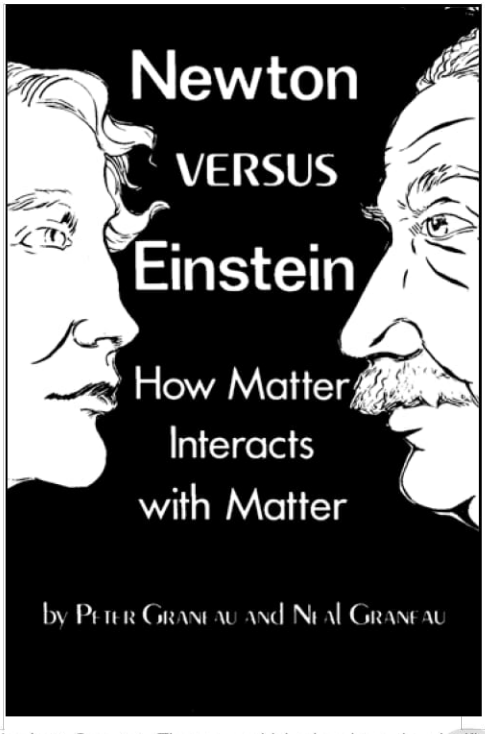
The authors feel, correctly, that there is a resemblance between the Academies of Science at present and the influence of the Church at the time of Galileo. There is effective censorship of ideas inconsistent with the I926 Quantum Theory or which play down the significance of Relativity. If new observations do not agree with the present physics, the investigator is accused of fraud or sloppy science....

But now, the authors believe, the dust has settled and there are too many aspects of present physics that seem inconsistent with observation. The time has come for a Great Re-Think. There is a telling quotation from Einstein in a letter written towards the end of his life to his old friend Besso. It states that field concepts may be entirely wrong. If they are, Einstein says, then all his endeavors and the rest of modern physics are up for re-forming.

This little book is the expression of workers who really do try to penetrate into the darkness, instead of singing the old song in a new style. But scientists like the Graneaus will never win the Nobel Prize. They ask too many disturbing questions to obtain the support of the establishment scientists who decide who gets the Prize.

Professor John O'M. Bockris,

JOURNAL OF SCIENTIFIC EXPLORATION, Spring 1995



ABOUT THE AUTHORS

Peter Graneau is well known for a long series of experiments in classical electrodynamics performed during thirty-five years in university and industrial laboratories on both sides of the Atlantic. The results he obtained were consistent with the old Newtonian electrodynamics which flourished in Europe during the nineteenth century. Dr. Graneau has published his findings in more than forty papers in prestigious physics and engineering journals and in his 1985 book *Ampere-Neumann Electrodynamics of Metals*. Some of his work has been sponsored by the U.S. National Science Foundation, which commended him for his efforts. The Graneaus make their home in the town of Concord, Massachusetts. They love nature, and they walk and canoe where Henry David Thoreau lived. In this beautiful area, Peter Graneau has time to contemplate the course physics may take in the next century.

Neal Graneau was born in London, England, and attended Fenn School in Concord, Phillips Exeter Academy in New Hampshire, and Winchester College in England. He traveled with school theater and poetry groups, and played piano recitals. Neal Graneau studied physics at King's College of London University, and at Oxford University as a graduate student. He is currently a full-time researcher at Oxford. For ten years, he spent his summers in his father's MIT laboratory. There this father-and-son team researched, invented, built and performed the experiments described in this book. When not at work, Neal finds time to relax by playing the drums in an Oxford group.

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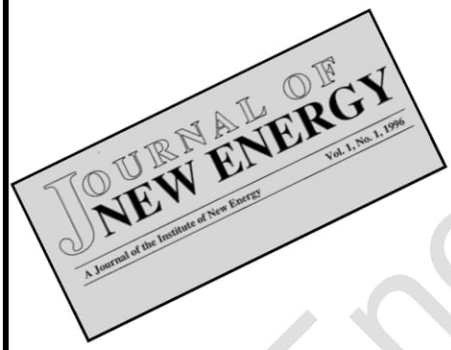
"Breaking Through" continued from p.4

old whipping boy, cold fusion. Frankly, if the Knight program at MIT can accept people with that low level of understanding about the basic process of science, it is in big trouble. But MIT these days is apparently a comfortable place for such as Taubes.

The National Association of Science Writers (an organization to which I formerly belonged) doesn't lag far behind Taubes in ignorance quotient with respect to cold fusion. In its *Field Guide for Science Writers* (Oxford University Press, 1997-Editors: Deborah Blum and Mary Knudson) one finds several juicy items, An example: From Boyce Rensberger of *The Washington Post,* "Although small bands of researchers continue to work on cold fusion, the vast majority of experts long ago dismissed it as a tantalizing illusion." Rensberger knows nothing but to follow the "consensus," and he does not even have his facts straight—"small bands"? Does that describe EPRI, the Japanese program, the Indian program etc., any one of which has done far more careful work that the naysayers who left the field long ago after a quick hit-and-run. Well, we can live without Taubes, Rensberger and the like. They will eventually concoct some explanation about "where they were eating lunch."



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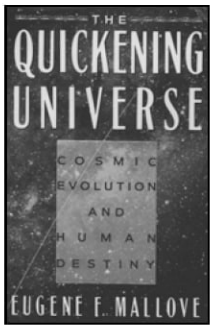

1987, St. Martin's Press, hard cover, 268 pages, illustrated by the author.

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Cold Fusion and The Future

Part 1 — Revolutionary Technology

by Jed Rothwell

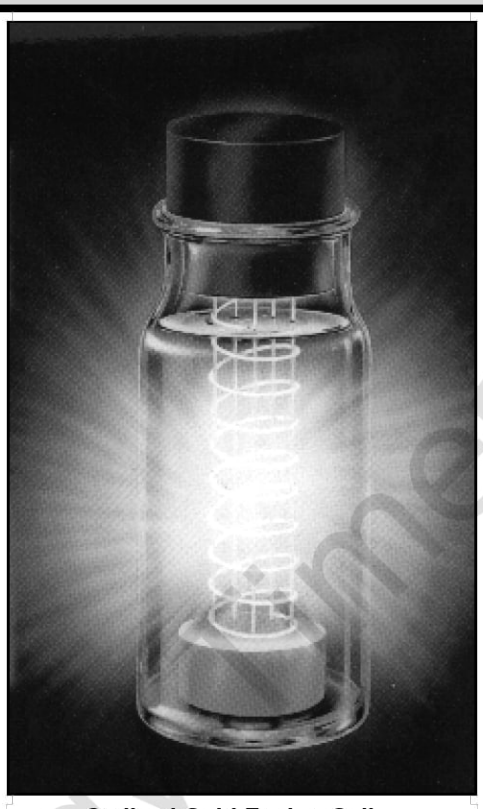
The heavy hydrogen in the seas can drive all our machines, heat all our cities, for as far ahead as we can imagine. If, as is perfectly possible, we are short of energy two generations from now, it will be through our own incompetence. We will be like Stone age men freezing to death on top of a coal bed. . . .

In this inconceivably enormous universe, we can never run out of energy or matter. But we can all too easily run out of brains.
- *Arthur C. Clarke,* Profiles of the Future*, Harper & Row, 1963, chapter 12, "Ages of Plenty"*

All the energy we can possibly ever use for free. Enough energy, if we wanted to draw on it, to melt all Earth into a big drop of impure liquid iron, and still never miss the energy so used. All the energy we could ever use, forever and forever and forever.
- *Isaac Asimov, "The Last Question,"* Science Fiction Quarterly*, November 1956, a description of a space-based solar energy collector*

Historians will look back on 1973 as the year the era of cheap energy ended and Americans began to confront the illusion that unlimited energy would always be available. It was also the year we realized that cheap, abundant energy was the all-pervasive factor in making the United States' success story the adventure of the ages. For the United States, it would mark a turning point — a new maturation and awareness of the bitter truth: we had overshot and were making an overdraft on our own, and the world's, resources.
- *Stewart Udall, Charles Conconi, David Osterhout,* The Energy Balloon*, McGrawHill 1974*

Energy is the most abundant resource in the universe. The sun produces 3.8 x 10^{26} watts,[1,2] enough to vaporize the earth in about a half-day. The energy crisis is caused by ignorance, not by any natural shortage.



Stylized Cold Fusion Cell—
"Hope for the Future"
from the cover of *Fire from Ice*
(Courtesy, Eugene Mallove)

I do not see the energy crisis as a purely moral issue. I disagree with the Spartan philosophy advocated by Udall, former President Carter and Vice President Gore.

Cold fusion energy will produce less junked equipment than solar or wind, because it is highly concentrated.

The energy crisis is a technical problem that should have been fixed decades ago. Americans do not use too much energy. The problem is that our energy sources are inefficient, expensive, dangerous and polluting. It does not have to be that way. Energy is a moral issue only in the sense that energy shortages cause terrible suffering in the third world. This cannot be fixed by taking fossil fuel away from Americans and Europeans and giving it to people in Africa and India. We would not be willing to part with it, and they cannot pay to transport it, store it, or use it effectively. There should be no need to conserve energy. There should be no need to pollute the air or blight the landscape with high tension power lines, or windmills or solar collectors. Even so-called "green" energy technology is destructive. Hydroelectric dams ruin the ecology, threaten to flood vast areas in Canada, and destroy ancient artifacts in China and Egypt.

With pollution-free energy, the only limit to our use of energy will be the capacity of the atmosphere to radiate waste heat from machines into space without excessively heating the surroundings. Cold fusion will not only eliminate pollution, it will also reduce this waste heat. Today's electric generators are about 30% efficient. Internal combustion automobile engines are only 15 to 19% efficient.[3] Carnot efficiency is poor because the engines have to pump through copious amounts of air to keep the gasoline burning. Cold fusion does not require oxygen, so a heat engine will be able to extract more heat from the working fluid. Internal combustion engines are also inefficient because they cannot stop. When the vehicle stops, they idle, wasting energy. At low speeds they are inefficient.[4] Other heat engines can store up energy when the vehicle is not moving. Steam and electric engines are efficient across a broad range of operating speeds.

Pollution is misplaced resources. We need mercury, but not in our water supply. We want ozone in the upper atmosphere, not at ground level where automobile engines produce it. No law of nature dictates that our energy sources must produce pollution. Fossil fuel sources always produce carbon dioxide, which might lead to global warming. Other sources, like wind and solar energy, produce very little pollution: only the solid waste of used solar panels and worn out windmills. Cold fusion energy will produce less junked equipment than solar or wind, because it is highly concentrated. There

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will be less solid waste when the machinery wears out. Under some conditions cold fusion will create tritium waste, but I expect these conditions can be avoided, and the danger of tritium eliminated. In that case, the only measurable reaction by-products from cold fusion will be tiny amounts of helium, and probably small levels of metal transmutations in the cathodes. These may include more precious metals than unwanted, dangerous elements. In any case, the cathodes will be inside permanently sealed heat cells, in engine blocks, impervious to all but the most severe accident. Some U.S. spacecraft employ thermoelectric generators powered by fissioning uranium oxide. In one case, a rocket went out of control and was detonated on launch. Divers found the thermoelectric generator on the ocean floor in perfect condition. It was installed in a replacement satellite and launched into space.[5]

How Much Heavy Water?

Cold fusion with palladium requires heavy water (deuterium oxide). Cold fusion with nickel appears to work as well with ordinary water as with heavy water. I expect nickel will become the dominant cathode material, in which case the fuel cost will be as close to zero as any fuel imaginable. Even heavy water fuel would be cheap. Heavy water costs about $1000 per kilogram retail, even though it is ubiquitous (it is 1 part in 6000 in every drop of water on earth). It is expensive because a lot of energy is required to separate it from ordinary water, and because demand is limited, so new separation technologies have not been developed.[6] But you get a fantastic amount of energy out of a fusion reaction. Even at $1000 per kilogram, heavy water would be thousands of times cheaper than oil. In a heavy water cold fusion economy, a fraction of a percent of the fuel would have to be recycled to keep the heavy water separation plants working, whereas today 7% of oil goes to refinery use and loss.[7] There are some indications that the cathode metal itself plays a role in the reaction. It may be transmuted, in which case it would be used up. A cold fusion reactor may require new metal from time to time, the way a fission reactor requires new uranium. Palladium and nickel are cheaper than uranium, and all three produce energy cheaper than oil does.

How much heavy water would it take to run the world economy, and what byproducts would it produce? Let us assume that cold fusion works like plasma fusion (hot fusion), converting deuterium into helium and releasing energy. Actually, it is probably more complicated than hot fusion, but broadly speaking it releases energy on the same scale, with roughly the same amount of fuel, and it does produce helium. Worldwide annual production of all fuels, converted to an equivalent mass of oil, equals approximately 6.8×10^{13} kilograms of oil.[8,9] This produces 2.7×10^{15} megajoules (at 40 megajoules per kilogram). A kilogram of heavy water contains 200 grams of deuterium. Converted to helium in a d-d fusion reaction, this produces 1.2×10^{8} megajoules, with 1.3 grams of matter annihilated.[10] Thus, present world energy needs could be met with 2.3×10^{7} kg of heavy water, or ~24,000 metric tons. Actually, as I pointed out above, Carnot efficiency is likely to improve with cold fusion, so less fuel will be needed. Byproducts would include 18,800 tons of free oxygen and 4,700 tons of helium. Thirty tons of mass would be annihilated, the same amount we lose today with chemical fuel, which also obeys Einstein's mass-energy equivalence law. To put it another way, a kilogram of heavy water has as much potential energy as 2.9 million kilograms of oil. The earth has ~2×10^{13} metric tons of heavy water,[11] enough to last 851 million years at this rate, and there is plenty more in Rings of Saturn and elsewhere in the solar system.

What it Will Take for Cold Fusion to Succeed

Three conditions must be met for cold fusion to succeed in every energy sector:

1. Cold fusion devices must be made safe and nonpolluting. Most scientists believe that before this can happen we must understand the physics of the reaction. Others say there are gaps in our theoretical understanding of related technologies like catalysis, yet we can make safe, effective catalytic processes.

2. Cold fusion generators, motors, heaters and other devices must have high power density, so they can be roughly as compact as competing motors. Data from some experiments shows that high power density can be achieved. In a few cases power density has been better than a conventional nuclear fission reactor. This kind of performance must become routine in all experiments.

3. It should be possible to build a wide range of devices from thermoelectric pacemaker batteries, to automobile engines, to marine and aerospace engines.

If condition one is not met, the technological revolution will be canceled. Without two and three it might be incomplete. We might end up with large, centralized cold fusion power reactors that make cheap energy. This will gradually reduce pollution, after electric automobiles are introduced.

Perhaps other over-unity devices like magnetic motors or the Correa device will pan out. Some of these would be superior to metal-lattice cold fusion (the Pons-Fleischmann effect). They would eliminate the need for heat engines and thermoelectric chips, thus reducing waste heat even more than cold fusion, especially when coupled with heat pumps. The broad technological and economic impact of these machines would be similar to that of cold fusion.

Before cold fusion can be commercialized, today's best, precious few laboratory prototypes must be made available to thousands of labs. Sustained boiling reactions have only been seen in one or two labs. They must be produced on demand, in any lab. Today, Edmund Storms spends months laboriously testing palladium samples to winnow out the ones that are likely to work.[12] That process must be automated. Ways must be found to fabricate cathodes that always meet his most stringent standards, and then the standards must be raised. Today, cold fusion experimental results are inconsistent. Heat flares up and gutters out, like flames from green, wet firewood. When we learn to control the reaction, we will scale up the type of cold fusion we want. We will not scale up the uncontrolled, on-again, off-again heat, or tritium production. Once we learn how to build this new kind of fire, we will make only clean, hot reactions, just as we only build clean, properly vented, smoke-free coal fires.

The Big Four

All machines use energy. Even a needle pulling thread uses energy provided by you. Nearly every machine on earth can be improved with cold fusion, but four categories are critical. Their performance depends on efficient energy consumption, and they consume more fuel than all others combined. They are:

1. Automobiles, trucks, railroad locomotives
2. Space heating and other furnaces
3. Electric generators
4. Farms

If cold fusion energy can be used in these four categories, it will replace almost all of the energy used by mankind, and it will reduce air and water pollution drastically. If it turns out that cold fusion can only be used for large electric generators, then

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it will gradually replace other energy sources. We will use electric space heaters and heat pumps. Automobiles will use batteries, or energy derived from electricity, such as hydrogen from electrolysis.

These four have the largest impact on the environment, and they consume most of the world's energy. Other critical machines like airplanes use a lot of fuel, but there are relatively few of them, so they consume only a small percent of the world supply. The issue is complicated by some machines like blast furnaces and railroad locomotives, because some use electricity and some burn fossil fuel directly. Machines like televisions, telephones, computers and x-ray machines use little energy. Cold fusion may improve their portability and reliability, but this will contribute little to conservation. The Energy Star computer standards have made laudable contributions to conservation, but things like electric motors and lighting consume much more energy than computers. Electric motors consume 50% of electricity. Lighting consumes 20% directly, and another 5% in air conditioning to remove waste heat from the light fixtures.[13]

The fourth "machine" on the list is the farm. Few people think of a field of lettuce as a solar energy powered production line, but that is one way to look at it. (Clarke described it that way years ago; he thought of everything.) A farm is an outdoor factory, like an oil refinery. Putting a farm outdoors has one big advantage: free energy, the light and heat from the sun. Unfortunately, it has many disadvantages. You get too much light and heat, or not enough. Things go catastrophically wrong. Insects and rodents eat the food. Crops must compete with weeds, and fight bacteria. Floods wash away seeds and fertilizer, and cause mildew. Farms suffer from droughts. Crops are reduced when it does not freeze hard enough in the winter, or wiped out when it freezes too late in the spring . . . With cold fusion, we can eliminate these problems by bringing food production inside. This will save an immense amount of land, it will reduce water pollution, and it will let us grow unlimited amounts of cheap, organic, wholesome, natural, clean, fresh food. This will be one of the biggest bonuses of cold fusion. It is discussed in detail below.

Cold fusion is ideal for heating and electric power generation. It might provide both from a cogenerator. In summer, you would let 70% or 80% of the heat go into the atmosphere, wasted, as you do today with your automobile.

Takes Getting Used To

Martin Fleischmann once said that cold fusion is like an old bicycle: you have to get used to it before you can believe it. The ramifications of cold fusion also take time to sink in. It is surprising how many experts overlook them at first. I have discussed cold fusion with petroleum experts several times. They begin by saying that it will not matter in the long run if the market for oil fuel dwindles away, because oil has many other uses as an industrial raw material for things like plastic. At present, 19% of oil is used in nonenergy applications, but experts say that the market will grow in the future. Clarke has said that in the future oil will be too valuable to burn. Hal Puthoff said that in a meeting, the presidents of Pennzoil, Texaco, Marathon, Coastal, and other oil companies told him they would welcome zero-cost energy. He paraphrased them: "When we take our precious resource out of the ground to make nylons, plastics, drugs, etc., we don't use up much and we have a large profit margin. When we take it out of the ground to power automobiles and heat people's homes, it's like heating your home by burning van Goghs and Picassos. Please take this burden off our industry. And, by the way, let us buy some to make our refineries more efficient." With all due respect, I think they were kidding him. I cannot believe these executives would be so sanguine at the prospect of losing 81% of their business. They get the same amount of money per barrel whether people burn the stuff or make nylon out of it. Why should they care what the customer does? In any case, I think they are wrong. They will lose 100% of their market. Oil will be worth nothing. I have asked experts: "Could you synthesize oil from raw materials? If I gave you carbon and water, could you make any hydrocarbon petrochemical you like?" They say yes, but it would take fantastic amounts of energy. It would be the most uneconomical chemical plant on earth. It does not occur to them, at first, that this would not be the case if energy costs nothing. I believe it will eventually be safer, more convenient and cheaper to synthesize petrochemicals at the plastics factory where they are needed, rather than digging them out of the ground and transporting them over great distances.

They will lose 100% of their market. Oil will be worth nothing.

As engineers find novel ways to use zero-cost energy they will soon come up with machines which it would be crazy to manufacture today. When a core technology changes or drops in price, it blossoms unpredictably. When computers became cheap in the 1980s, they were used in toys, fuel injection controllers, spreadsheets, word processors, e-mail, video cameras, and thousands of other ways nobody imagined earlier. It would have been absurd to develop such things for mainframe or minicomputers. Only a millionaire could have run a computer game on a mainframe computer.

The New Imitates the Old at First . . .

The first automobiles looked like horseless carriages. The first cold fusion powered automobiles will look like today's models. They will have the same kind of body, tires, controls and electronics. Years ago, automobiles came in many different shapes and sizes. Because of safety regulations and aerodynamics, they all look about the same now. The cold fusion car will look the same externally. Under the hood it will have a smaller engine that develops more power. There will be no exhaust pipe or muffler, no pollution controls, no gas tank or fuel gauge. A car will come with a permanent supply of fuel built in: a cupful of water. This water may have to be changed out annually to reduce contamination. Or it may last for years, like the acid in an automobile battery. During the lifetime of the car, only a tiny fraction of the water will be used up. The rest will be disposed of when the car engine is scrapped. Although heavy water is toxic when drunk in large quantities, when it is mixed with ordinary water it rapidly disperses to its natural concentration (1 part in 6000). It is hygroscopic. When exposed to air it absorbs ordinary water and gradually returns to the natural concentration.

The first cold fusion generators will also look like today's models. The designer will take out the coal-fired boiler, put in a cold fusion heated boiler, and leave the steam turbine and other components unchanged as much as possible. Engineers prefer tried-and-true designs; they only innovate when they have to. Space heaters will attach to the same hot air ducts or radiators. They will be subject to the same safety and installation laws. Electric generators will be connected to the fuse box where the power company line now comes.

New technology often starts out as a one-for-one replacement for the old. New materials are sometimes literally interwoven with the old, like the iron in 19th century wooden ships:

> Early practice was to have an iron part similar to every wooden part . . . Many shipowners were prejudiced against

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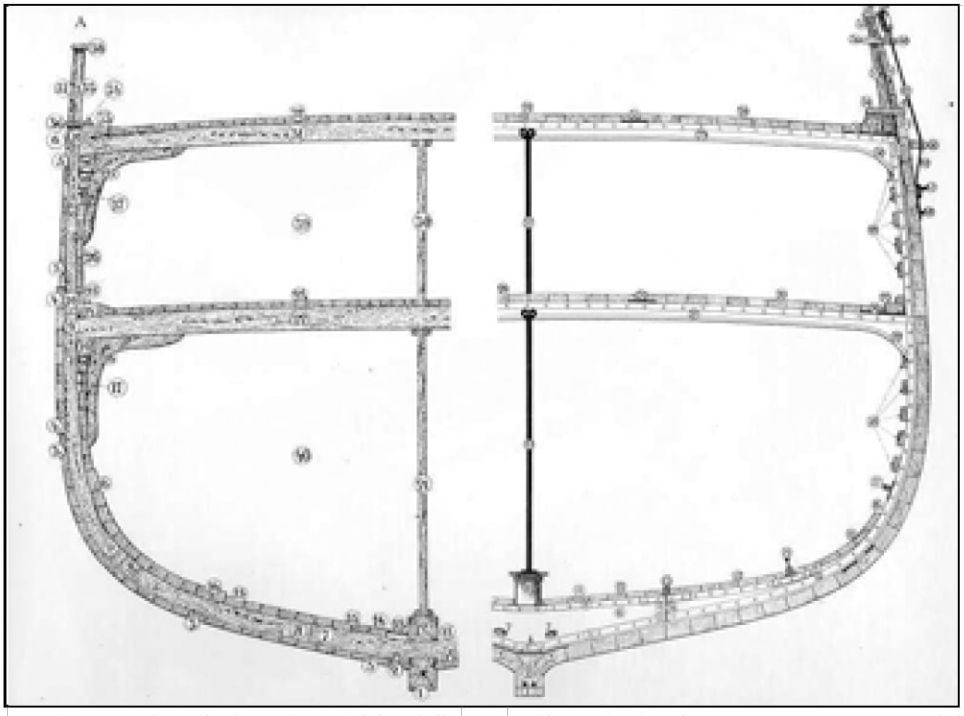

> iron, and so before it could be fully adopted there was an interim phase of the composite ship, in which iron framing and tie plates were used with wood planking and decking . . .[14]

New technology often starts out imitating older forms, even when it would work better if it did not. Early Chinese clay pots were modeled to look like woven baskets. The first plastic household objects and furniture were made to look like wood, wicker, and other traditional materials. In the 1960s plastic chairs began to look like plastic. Years ago I saw a demonstration of a word processor designed to look like a typewriter. New text appeared only on the bottom line of the screen, the cursor did not move around. To change a line you had to "roll" the text down, like an imaginary sheet of paper. With great ingenuity, the limitations of the old technology were imposed on the new. The salesman explained that this would make secretaries feel at home with the machine. Electric power plant control rooms have unnecessarily large controls built like old-fashioned J-handle ("pistol-grip") switches to press small electric contacts. In older plants these controls had to be large because they were mechanically connected to the equipment they actuated. An official study concluded that this was one of the contributing factors to the Three Mile Island accident. "Valuable control space is wasted – and other controls are put out of the operators' reach – by the failure to scale down control size."[15]

New technology can cause social change, or it can prop up obsolescent technology and social customs. Antebellum slavery in the U.S. was declining until Eli Whitney introduced the cotton gin, making cotton more competitive with other fibers. Many observers feel that modern Japanese orthography is too difficult for the average reader.[16] For a while it appeared to be in decline. People forget how to write the more complex characters. They substitute syllabary (kana) instead. Young people watch television and read comic books with simplified writing, instead of reading novels and newspapers. But the boom in low cost word processors has turned the situation around, at least temporarily. People's ability to write characters by hand is probably at an all-time postwar low, but everyone can churn them out with word processors that are as cheap as electronic typewriters in the U.S. The machines are so addictive some people write grocery lists with them.

With cold fusion there will be no network to maintain, and no economic losses from massive power failures.

With cold fusion, people will try to prolong the life of obsolescent machines. They may succeed in some cases. Sailing ships achieved a final, short-lived heyday in the 1860s, forty years after the first steamship crossed the Atlantic. This success was due to improved marine engineering and to the use of steam tugboats, which allowed large, unwieldy wooden sailing ships to dock, maneuver in tight channels, and reach the open sea before setting sail. Steam engines first prolonged the age of sail, then slowly brought it to an end. People will try to prop up the electric power companies with cold fusion, by developing large, central power generators with cold fusion in place of coal or fission. In the long run they will fail, for five reasons:

1. Large, central generators are good because they are fuel efficient. Over the life of the equipment, the fuel costs more than the machinery. With cold fusion the fuel cost will be zero with any generator, of any size or efficiency. There are no economies of scale.

2. The power companies have to pay for transmission grid: the network of high tension power lines, poles, transformers, the computer monitoring. This cost will be eliminated with decentralized generators.

3. Central generators are complex, dangerous machines, because they are optimized to be efficient. Home generators will be optimized to be maintenance free instead. They will trade off efficiency (which will no longer matter) for low maintenance.

4. Central generators are maintained by experts to keep pollution at a minimum. This will not be an issue with cold fusion.

5. The equipment cost of central generators is cheaper per capita. With central generating, you share capacity, and you only use it when you need it. Large factories use electricity at night at lower rates, when extra capacity is available. This is true, but it will be irrelevant to the consumer. ***The economics will change, making it cheaper for a homeowner to purchase all of the generating capacity he needs, rather than sharing equipment.***

Let us look closer at some of these points.

A hurricane can cause millions of dollars in damage to the power distribution network, and black out whole cities for days. Skilled crews of highly paid workers maintain the network and repair damage. Eight percent of electricity is lost in transmission across the network.[17] With cold fusion there will be no network to maintain, and no economic losses from massive power failures. Individual generators will break occasionally, as do refrigerators, water heaters and furnaces today.

Electric generators are complex, dangerous machines that require constant attention by experts, and frequent scheduled maintenance. Power company engineers say that an ordinary person could

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not maintain such a complicated machine in his basement. This is like saying that a person could never manage an IBM 360 mainframe computer in his den. A personal computer is nothing like a 1965 mainframe. Home generators will not be scaled-down power plants. They will be based on simpler designs. They will be fully automatic and maintenance-free for long periods of time. Eventually, they will have no moving parts, like the thermoelectric generators used in spacecraft, which work reliably for decades without maintenance. Central generators will also evolve into maintenance free machines, but they will lag, just as mainframe computers have never been as easy to use and maintain as small computers.

Central generators must be kept at peak performance and closely monitored to reduce air pollution to the lowest possible level. A million distributed gas or oil cogenerators would be the responsibility of a million householders. People would neglect them, just as they neglect automobiles. The cogenerators would produce more pollution than a central generator generating an equivalent amount of electricity. But a cold fusion generator will produce no pollution, no matter how much the homeowner neglects it.

Central power generators are cheaper per capita. It would cost thousands of dollars to install enough generating capacity in your house to meet peak demands. With central generating, you share capacity. Large customers use electricity at night at lower rates. With individual generators, every house, shopping mall, and factory would waste most generator capacity most hours of the day. This is true but irrelevant to the consumer. We waste the unused capacity of our automobiles when we leave them parked most hours of the day. We could take a train or taxicab instead, which would conserve equipment, but it would waste our time, which is more valuable. The homeowner will find it more economical to purchase generating equipment and leave it idle most of the day, rather than renting a smaller share of a central generator. There are two reasons:

1. As noted above, you do not have to pay for your share of the power distribution network when the entire generator fits in your house.

2. A homeowner can take advantage of the new technology and begin pocketing the savings immediately; the power company cannot.

Homeowners will leapfrog the power companies because they do not have an installed base of equipment. Assume a cold fusion co-generator costs the same as a gas-fired one: $8,500.[18] Assume it lasts 15 years and saves $200 per month on average, offsetting both gas and electric bills. It would pay for itself in three and half years, and save an additional $27,500 before it wears out. That is $1800 per year over the life of the machine, a 22% return on investment. (It is 28% if you factor in the money you would have to spend for a furnace anyway.) The power company cannot offer you the same savings because it cannot scrap its installed base of equipment overnight. Massive power generators take years to plan, approve, and install. A household appliance can be replaced in a week, on a whim. The decision is made by a homeowner without hearings or committees.

Electric companies have survived with large scale equipment, planning, overhead, complexity, and the burden of paying expert management because these things serve useful purposes. They enhance efficiency and reliability, and reduce pollution. They reduce cost. These advantages will disappear with cold fusion.

Revolutionary Products

Automobiles and electric generators will come first. Other machines will soon take advantage of unlimited energy. Many could be made today but they would not be economically practical. Others would be impossible. Here are some of my favorite possibilities. Many are borrowed from Clarke's *Profiles of the Future*. Some of these will require breakthroughs in other areas, like thermoelectric chips and spacecraft propulsion. Cold fusion will act as a spur to these breakthroughs. It will enable rapid development of these other machines, the way steam locomotives spurred the development of air brakes.

Portable computers, telephone repeaters, cellular phones, aircraft black box recorders and other electronic devices that operate continuously for decades without recharging, with thermoelectric batteries.

New forms of aircraft with much larger payloads. These might be hovercraft, vertical take off and landing (VTOL) airplanes, or possibly airships (zeppelins). Airplanes and helicopters will have unlimited range. Spacecraft will carry larger payloads, but range will still be limited by the need to carry propellant.

Small, pilotless, propeller driven drone aircraft that fly thousands of meters high and circle around a small area, staying in same position for months. They will carry TV, radio and telephone repeaters, like geostationary satellites. They will cover less area than satellites. This might be an advantage for cellular telephone applications. They could be used far north or south of the equator, or even over the North Pole. In northern Canada and Alaska geostationary satellites are too low on the horizon for good reception.

Cold fusion transport will culminate with the invention of the ultimate liberation machine: a cost effective, reusable space rocket that will allow us to fly to the Moon as cheaply as we fly from New York to Tokyo today.

Powerful new digging engines will take advantage of the improved power density and portability, and the ability to operate without oxygen. Another invention may be perfected: the thin film diamond coated cutting blade. Together they would make vast underground construction easier and cheaper on earth and, later, on the moon.

Food factories, described below.

Improved, low-cost desalinization and distillation of water will make the deserts of the world bloom, transforming the Sahara and the Gobi into forest or productive farmland competing with the food factories.

Improved extraction of metals from ore. Clarke points out that in conjunction with large scale desalination projects, we might extract useful elements from sea water.[19] He notes that a cubic mile of seawater (4 billion tons) contains 30 million tons of elements other than water, including 18 million tons of magnesium and 20 tons of gold.

Unfortunately, there are many potential military applications for cold fusion, which are discussed below.

Medical applications include a cold fusion powered pacemaker that lasts for decades. Self powered prosthetic limbs and devices to assist muscles weakened by disease might become possible. Perhaps, if other problems can be overcome, a sealed, self-powered artificial heart might become possible. Portable monitors and intravenous pumps will become safer, smaller and more reliable, there will no longer be any fear of battery power running down. Microscopic, implantable monitors might be developed.

Toxic chemical compounds can be destroyed by exposing them to high temperatures molten metal in a sealed container, which prevents the harmful emissions of conventional methods. A "superfund" toxic waste site could be converted into its base elements. This does not solve the problem of toxic elements, like arsenic, but it eliminates compounds made of nontoxic elements, organic chemicals, sewage, and medical waste. This approach is being pioneered by Molten Metals Technology, Inc., a $313 million company in Massachusetts.[20]

Automobiles

Transportation consumes 24% of world energy output, most of it in cars and

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trucks. The pace of progress in the development of automobile engines has been slow over the last fifty years. Manufacturers spent years developing diesel engines and rotary engines, only to abandon them later. General Motors spent approximately $300 million developing the rotary engine in the 1970s, but it never sold a single one.[21] Cold fusion will not allow a long product development schedule. After people realize it is real, every manufacturer will have to work feverishly to bring fusion trucks and cars to market, or soon face bankruptcy.

There will be a period of experimentation with compact steam turbines, thermoelectric engines, Stirling engines, and a variety of other external combustion style heat engines.

Long distance trucks and railroad trains will be the first important transportation market for cold fusion. Trucks consume thousands of dollars each year on fuel. In a few years, any trucking company that still buys diesel fuel will go out of business.

Cold fusion automobiles will be popular, although there will not be as strong an economic incentive to buy a car as there will be with trucks. In a few years people will consider a gasoline powered car an obsolete, smelly nuisance. As gasoline cars wear out, they will be replaced with cold fusion powered ones.

Cold fusion cars will be large and heavy like expensive U.S. models. There will be no reason to make them lightweight. Consumers prefer heavier cars, because they handle better, they are quieter inside, and safer in an accident. Cold fusion cars will be cheaper to manufacture than gas powered models. They will have simple, steel bodies, which are easier to recycle. Designers will jettison antipollution devices; expensive lightweight aluminum and plastic body parts; expensive energy efficient oil pumps and air conditioners; and aerodynamic, molded light fixtures that are expensive to replace after an accident. They will dispense with the fuel tank, exhaust and muffler. They will cancel research to meet miles-per-gallon and pollution control standards.

Cars will be equipped with a solid state thermoelectric air conditioner/heaters, which the driver will leave running when the car is parked. Fusion powered vans will be equipped with energy intensive devices like refrigerators. Cars and vans will have heavy duty alternating current power outlets under the dashboard. People go for that kind of thing.

In California, the antipollution laws will be amended to ban gasoline cars. Atlanta, New York and other large cities will follow. Once a quarter of the cars on the road are fusion powered, gas stations will begin going out of business in droves, because they operate on thin margins. In the oil price shocks of the 1970s, when consumption dropped a few percent, many gasoline stations went out of business. It will become more and more inconvenient to own a gasoline car. They will soon go out of production, and spare parts will become hard to find.

New Aircraft

The biggest safety threat in an air accident is fire, from burning fuel. Cold fusion will eliminate this. If a damaged cold fusion aircraft can crash land intact, it will not explode. The biggest performance limitation for an airplane is the distance it can fly on one tank of fuel. On a long distance flight the fuel can weigh as much as the payload. A cold fusion airplane could fly around the world on a cup of heavy water. The weight of the fuel can be replaced with payload.

Airplanes suffer from two related problems: they carry a small payload and they have to keep moving or they crash. Jumbo jets carry up to 500 people. Boeing is now floating a proposal for a 1,000 passenger airplane. Nobody has seriously considered building anything larger than that. The first ocean liner large enough to comfortably accommodate more than 2,000 passengers was the Great Eastern, launched in 1858. Conventional airplanes will probably never carry more than 1,000 passengers because of the second limitation: they cannot slow down, or stop and hover in the air. So they need runways, and they must remain kilometers apart in the air for safety. The bigger the airplane, the longer the runway it needs, and the more stress it puts on the runway and landing gear. An airplane with the capacity of the Great Eastern would require a gigantic runway, longer and wider than we can afford to build near most cities. But, a giant aircraft that can hover does not need a runway. It can land gently, near the terminal. Several tires strike the ground simultaneously, which puts no excessive strain on the concrete or landing gear. When air traffic is congested, the aircraft can slow down or even stop and wait high above the airport in a fixed position close to other stopped aircraft, like cars waiting at a traffic light. Airplanes waiting to land will not need to orbit in giant circles, with a gap of several miles between them. This will make the air traffic controller's job easier. So would multiple, decentralized airports and direct landing of freight in factories, shopping malls, and trucking yards. Traffic will no longer come through the bottleneck of one large airport.

After people realize it is real, every manufacturer will have to work feverishly to bring fusion trucks and cars to market, or soon face bankruptcy.

Three kinds of large aircraft can hover:
1. A hovercraft, also known as air-cushion vehicle (ACV), or ground-effect machine.
2. An airship; a zeppelin.
3. A vertical takeoff and landing airplane (VTOL), like the Harrier jump jet fighter.

Hovercraft and airships have trouble competing comercially because they are slower than airplanes. This is a problem on many routes for passengers, but it is not so important for air freight. They are faster and more flexible than ships. Hovercraft are widely used by the military, which likes them because they fly over water, sand, marshes, barbed wire or mine fields with equal ease, a meter or more up in the air. The U.S. Navy has a large fleet of armored hovercraft landing craft.

Gigantic rigid hot-air lift airships are zeppelins that use hot air instead of hydrogen or helium gas. They might use a combination of hot air and helium. Modern designs are described in the book *The Deltoid Pumpkin Seed*.[22,23] Airships could transport thousands of tons of freight or raw materials from continent to continent. A large one might have the capacity of an ocean freighter. It could fly a hundred tanks and soldiers halfway around the world in a few days. It would not require an airport to land, just an open space. An airship might hover over uneven ground or a strip mine while loading ore.

Unless an anti gravity machine is possible, airships are likely to remain the quietest form of air transport. Hydrogen-filled airships like the Hindenburg were dangerous, but helium and hot air ships are safe.

Changes to Infrastructure

Pollution free transport and access to massive amounts of energy will gradually change the appearance of our cities, buildings, factories and highways.

In Japan, tracts of level, open land are rare, and small, steep mountains are common. There are many tunnels along highways and railways. With cold fusion powered robot excavating machines, the country will begin to look like Swiss cheese. Eight lane highways might be built underground, four north lanes on the top level, four south lanes below that. The biggest problem will be to dispose of the excavated dirt and rock. The Japanese do this by filling in the ocean and Tokyo bay. They

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leveled off small mountains outside Osaka to build the new international airport. Eventually, excavation might get so cheap that factories and warehouses are built underground, and tall buildings have as many floors underground as they do above ground. Large underground shopping malls that seem to stretch for miles are already found around most major urban railway stations in Japan. Underground construction has a big advantage in Japan. It is impervious to earthquakes. People in the BART subway stations barely felt the 1989 San Francisco earthquake.

Automobile tunnels and underground factories will be easier to engineer because ventilation will no longer be a major problem. Oil burning vehicles will be prohibited from the tunnels because they would asphyxiate passengers, just as a diesel railroad locomotive would in a tunnel designed for electric trains. Oil burning cars will also be prohibited because they are dangerous: they sometimes explode in accidents. Fusion cars might smolder after a severe accident, but they will not explode.

The tunnels will be shielded from the weather. Driving conditions in them will always be optimum. The roads in them will never have to be torn up to install sewers or power lines, because these will be run in separate, smaller tunnels, closer to the surface. Sensors and cameras will be added to catch speeders, as well as antennae for radio, television and cellular telephones. Since the tunnels will be protected from weather, and the vehicles will not pollute, the high tech equipment will last longer than it would on old fashioned surface roads. These roads will be well suited to fully automated, self driving, computerized automobiles.

Highway congestion will be relieved by increased use of aircraft. Many of the trucks on the highways are already being replaced with airplanes, with the growth of overnight delivery services. Cold fusion will make air transport much cheaper. As noted above, if VTOL aircraft can be perfected, goods can be shipped directly from factories to grocery stores and shopping malls in VTOL craft, that land in the parking lot or on the roofs of the buildings.

I cannot envision a conventional aircraft or hovercraft capable of landing in an urban neighborhood. A flying moving van would make too much wind and commotion. For that, we will need something like a silent, antigravity machine – if such a thing is possible. Cold fusion powered airplane engines will probably be quieter than conventional engines, but as long as we use jets of air to push aircraft, they will not be suitable for densely populated neighborhoods. In rural and wilderness areas in places like Alaska, private family airplanes are common. Their use will increase as cold fusion, better air traffic control, and global positioning satellites combine to make them safer and easier to fly.

Military Applications

Cold fusion will play a crucial role in future military technology, even if it can only be used for prosaic items like the motors and electric power supplies used in civilian consumer applications. Many crucial military technologies originated as ordinary civilian technologies, for example, railroads played a crucial role in the U.S. Civil War and in the First World War. In *Crusade in Europe*,[24] Eisenhower wrote:

> . . . four other pieces of equipment tha most senior officers came to regard as among the most vital to our success in Africa and Europe were the bulldozer, the jeep, the 2fi ton truck, and the C-47 [DC-3] airplane. Curiously, none of these is designed for combat.

Many other civilian technologies played crucial roles in World War II, including high octane gasoline, radio, and penicillin.

High performance cold fusion engines in helicopters, tanks and trucks will change the nature of these weapons. This will extend the operating range indefinitely. If the pilot and copilot could stay awake long enough, a cold fusion-powered helicopter could take off anywhere on earth and fly anywhere else, nonstop. It could fly at top speed, which is about 400 km/hr (250 mph) for today's helicopters. There is no need for a 'cruising speed' to reduce fuel consumption. Ships, tanks, helicopters, and transport aircraft will go for months without refueling, just as fission powered aircraft carriers and submarines do today. One of the biggest headaches in tank warfare is logistics and fuel resupply. The Allied invasion of Europe was stalled in the fall of 1944 partly because of fuel shortages. The German tank armies were stopped in the Battle of the Bulge when they ran out of gas. Fuel, fuel depots, and transporting fuel were a tremendous logistical headache during the recent Gulf War. A cold fusion-powered tank will run until the treads fall off without refueling. Armored hovercraft tanks would have unlimited range.

Jet and ramjet aircraft will fly at many times the speed of sound for as long as the crew have food and water. Cold fusion will not give rockets infinite operating range, because rockets must carry propellant. Cold fusion can extend the range of rocket powered space vehicles by lifting them high into the atmosphere with conventional turbine motors. A rocket-plane might leave the atmosphere, cruise through space, and re-enter at will. With a cold fusion-powered rocket, water might be the best propellant, because it cannot explode. It would be expelled as superheated steam. Today's rockets use explosive chemical fuel, which serves as both fuel and propellant.

At the time of the First World War, capital ships were converted from coal to oil. A ship can be retrofitted with a new type of engine, an airplane cannot, because aircraft design is too closely tied to engine performance. The billions of dollars now being spent to build a new generation of kerosene powered fighter airplanes will be wasted. The machines will be scrapped soon after they are manufactured.

Small cold fusion cruise missiles will have unlimited range and endurance. With Global Positioning Satellite (GPS) navigation, they will take off from any spot on earth and fly anywhere else. They can search for a target for days, or months. They will weave up and down the landscape, loitering, waiting for a truck, train or convoy to pass, or above the sea waiting for a ship. They might circle around a target indefinitely, waiting to attack on command, or keeping tabs on it, reporting its position back to headquarters. Pilotless propeller aircraft could also carry cameras for mapping, reconnaissance, and spying. An autonomous cold fusion torpedo will be similar to a cruise missile. You could launch it anywhere. It could cross an ocean and cruise around an enemy coast waiting for a ship to come along, and then attack it.

Another potential use for long range torpedoes is based upon an idea that has been proposed by many scientists including Freeman Dyson.[25] They have suggested that a kind of "mechanical limpet mine" or "suckerfish" could be used to keep track of nuclear submarines. These small, robot devices clamp onto the bottoms of passing submarines and continually report their position back to headquarters. The sailors in the submarine or surface ship might realize the limpet was attached. According to the late Admiral Sir Anthony Griffin, experts in the Royal Navy are trained to dive under ships stopped in mid-ocean and remove such mines.[26] In wartime this would be a hazardous undertaking for both the diver and the ship, which would be vulnerable to attack. Cold fusion makes the limpet idea easier to implement, and more effective. It would be difficult to remove one or two such mines; imagine trying to remove a hundred of them with cold fusion power supplies and computers programmed to detect divers and scuttle away

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from them to a new spot on the hull. The limpet might not need to attach itself. It might swim along next to the hull.

A torpedo-like cold fusion drone submarine might be equipped with spy gear and radios instead of a warhead. In peacetime, it might be programmed to loiter around in international waters outside an enemy submarine port. When a submarine passes by to take up patrol, the drone would tag along after it, getting as close as possible. It would keep tabs on the submarine throughout the entire mission. It would record sounds and signals emanating from the submarine. A school of drones might follow a submarine, reporting its position, speed, and bearing every ten minutes back to headquarters. One of the problems with the limpet scheme is that you cannot easily broadcast a radio message from underwater. However, if you had a school of a hundred tag along torpedoes, several of them could be assigned to stack up in a column above the submarine, each staying in contact with the one below it. The top one would dart to the surface every ten minutes to broadcast a report via satellite, and then return to join the school. A hundred drones would cost a lot of money, but nowhere near as much as the manned submarine they are assigned to follow. They would be programmed to cross the ocean and return home for maintenance at regular intervals, in relays. This constant surveillance would render the submarine useless. A submarine's only advantage is its ability to hide. Surrounded by drones, it would be as "visible" as any surface ship is to radar and satellite. If the enemy knows precisely where a submarine is, where it is headed, and what the captain said to the first mate a half-hour ago, it might as well be a surface ship or a shore installation under satellite reconnaissance. A nuclear missile submarine is a deterrent only because its location is secret.

If a war seemed imminent, a dozen members of the tag along school might be armed with warheads. When war is declared, they could be ordered to attack the submarine. Armed tag along torpedoes could be assigned to follow every aircraft carrier, cruiser, and other ship in an enemy fleet. Even if a dozen were assigned to follow one ship, they would still be cheaper to build and maintain than the smallest seagoing manned vessel.

Nuclear Weapons

Most experts say it is unlikely that a cold fusion powered nuclear bomb can be built. Let us hope they are right. Cold fusion devices are cheap. If a cold fusion bomb is possible, someone might be able to mass produce thousands of devices the size of shoe boxes, each with the power of the Hiroshima bomb, costing a thousand dollars apiece. They would be undetectable. They might become as common as Stinger Missiles, which are reportedly available in the third world weapons bazaars. It is cold comfort, but terrorists have never used a Stinger Missile against defenseless civilian aircraft. They have, however, put a powerful bomb in the World Trade Center. If they had acquired a small thermonuclear fusion bomb from the arsenal of the former Soviet Union, the result would have been unthinkable.

You would not think of producing shoes, potato chips, or computer chips in an open field. It is not a good place to produce food either.

Cold fusion appears to be limited to slow, relatively low power reactions, which require an intact metal lattice. Cold fusion is not a chain reaction, like fission. When one hydrogen atom undergoes a cold fusion reaction, it does not directly trigger another atom. It will raise the temperature unless you remove the heat, which can spur the reaction. There are some indications that if you let a cell overheat, the reaction can quickly increase to high levels until the metal melts. This would destroy the lattice and instantly quench the reaction. It does not seem to be a practical way to make a bomb.

Pons and Fleischmann reported that a meltdown might have occurred. This is not alarming. A practical cold fusion motor or engine could be designed to prevent this from happening. It would have safety devices, radiators, and emergency valves to prevent overheating, just like any other heat engine. Conventional engines can overheat or go out of control. Automobile engines catch on fire; overheat. Helicopter engines can lose lubricant and explode. Perhaps on rare occasions cold fusion engines will go out of control and perhaps even melt down. Before these engines come into widespread use, it will be necessary to test them by deliberately disabling safety features to find out what happens during a catastrophe.

Although a bomb is not a likely threat, cold fusion can be used to generate tritium, which is dangerous. Furthermore, it is an essential ingredient for a thermonuclear hydrogen bomb. You cannot make a bomb without tritium, and you cannot make tritium without a massive, expensive reactor. The only U.S. facility capable of making it is the Savannah River Plant, which has been shut down indefinitely. The half-life of tritium is 12.3 years. If the Savannah River plant is shut down permanently, the U.S. supply of tritium will fall by half every 12.3 years. For a while, old tritium can be scavenged out of decommissioned warheads, which are in oversupply thanks to the arms reductions treaties. Eventually, the natural decline will begin automatically squeezing down the number of warheads, unless a replacement for the Savannah River plant is built. Some policy makers have welcomed this as a mechanism for automatic scheduled arms reductions. It is difficult to hide a massive tritium reactor facility from satellite reconnaissance. If the Russians, Chinese and others agree to shut down their tritium production, we can be certain they will have to throw away half of their remaining warheads every 12.3 years. Cold fusion may disrupt this automatic arms reduction scheme. Occasionally, cold fusion reactions generate copious amounts of tritium. Most create no measurable amounts of tritium at all. Nobody knows why yet. We will have to find out before cold fusion generators and automobiles can be built. Some set of physical laws govern tritium production. Once we understand those laws, or, at least, once we establish reliable empirical means of prediction, it should be possible to ensure tritium-free heat production. Unfortunately, this means it will also be possible to enhance tritium production, although nobody can predict to what extent. A third world country might be able to construct a small, hidden, cut-rate version of the Savannah River plant.

Food Factories

The main reason people grow food in fields outside is that solar energy is free. If we can get as much light and heat indoors, at zero cost, we can do much better growing things indoors. Outdoor farms suffer from a long list of problems like drought, floods, erosion, insects, storms, and so on. "Outside" is a terrible place for a production line – which is what a row of corn really is. You would not think of producing shoes, potato chips, or computer chips in an open field. It is not a good place to produce food either. Farmers sometimes lose half of their crops to frost, drought, or insects. In any other industry this would be considered disastrous performance. An auto plant, a computer chip or a potato chip factory that lost half of its annual output because of a late frost would face bankruptcy. Farms are subject to the whims of nature, so we are forced to accept large losses, unpredictability, and overall low efficiency. Sunlight is the only

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pollution-free, zero cost source of energy abundant enough to grow food for everyone on earth.

A food factory is a large scale indoor farm. It is like a greenhouse. Experimental food factories already exist. The *Yomiuri* newspaper reports that hydroponically grown produce is popular in Japan.[27] People like it because it is "totally pesticide free." There are no insects in the factory, so no need for pesticides. Factory grown food is "more natural"; it ought to appeal to people who want organic, pesticide-free diets, once they get over the shock of that idea. During the spring and summer factory grown vegetables are about 50% more expensive than field grown ones, but in winter they are 30 to 40% cheaper. Food-factories make economic sense in Japan, where land prices and strawberries are expensive. They would be even more economically attractive if the electricity was free. In Iceland, food factories are warmed by volcanic hot springs, another zero-cost source of energy, like the sun, or cold fusion. In the Netherlands, flowers worth $1.8 billion per year are grown hydroponically in greenhouses. Flowers are grown, cut, packaged, auctioned, and air shipped to cities all over the world from a gigantic indoor complex the size of 100 football fields. Rose bushes grow "for four years without touching soil" in water filled with an ideal mixture of fertilizer and plant food. Computers control levels of light and nutrients to meet peak demand on Mother's Day and at other times of the year.[28] A company in Massachusetts grows 900,000 striped bass in an aquiculture factory on an acre of land.[29] The fish are healthier and better tasting than fish grown in the wild, or in aquiculture ponds. The machines produce a rapid current, forcing the fish to swim vigorously 20 miles per day, which improves the flavor of the meat. The fish grow to market size in nine months, half the time it usually takes. The water discharged by the factory "exceeds numerous drinking water standards," according to state environmental officials.

The factories double as storage warehouses. The robots in a tomato factory will plant a thousand bushels every week, and vary light and temperature to create artificial growing seasons on each floor. The tomatoes will ripen in stages throughout the year. They will be shipped to stores a few miles from the building. They would not require elaborate packaging or preservation. They will arrive at the stores within hours of peak ripeness.

Food factories can be located near population centers, or possibly beneath large cities. In the distant future, a fully automated food farm might be located directly under a grocery store. Produce would never be shipped more than a few hundred meters, straight up, and no fruit or vegetable would be less than perfectly vine ripe. Alternatively, it might be more economical to build the factories in out-of-the way locations where land is cheap: deserts, inaccessible mountain ranges, or the moon. Perhaps robot driven VTOL aircraft and spacecraft will ship garbage from cities to the food factories, and bring back produce.

Food factories are not biotechnological factories. They are not the factories depicted in science fiction, which take in garbage and synthesize food hours later. In a food factory, food is grown from seeds and livestock, like a conventional farm. The production line throughput is one to six months. Factories producing automobiles and consumer goods generally move products from start to finish in days or weeks, so they require less floor space than food factories. Food factories have large inventories and slow production lines. We have always had some kinds of food factories, including breweries and cheese factories. Some take months to produce a batch of goods. Some take years.

Food Factories And Famine

A few thousand large food factories in the third world would stabilize supplies and banish the threat of famine. The factories would not need enough capacity to feed the entire population. They would stop incipient famines by stabilizing supplies. Most famines are not caused by the weather or by natural disasters, because these are limited in geographic scope. In an organized society, relief supplies can always be shipped in. Famine is caused by economics, politics, war, or poor government planning. Famines are triggered when a bad harvest or a war disrupts the food supply. People panic, and hoard food. Prices shoot up, and the famine begins. Sometimes, as people starve, unsold food rots in warehouses. It is too expensive for poor people. Chaos disrupts transportion. If the people can be assured that adequate emergency supplies exist in food factories, panic will not set in, prices will remain stable, and famine will be averted.

A million large food factories in the third world would bankrupt the third-world farmers, causing widespread social disruption. It would reduce U.S. exports of food, hurting our balance of payments. Once the factories are developed, I cannot imagine why they would not become increasingly cheap, gradually supplanting outdoor farms and disrupting agricultural employment worldwide. No human can work as cheaply as a robot.

Food Factories in The Future

Food factories will eventually make farms obsolete. They take up a fraction of the land of farms they replace, because crops in them can be grown in shelves one or two meters apart. Suppose a food factory covers 100 hectares (250 acres), like a shopping mall or a large office park. It is 25 stories high (80 meters), and grows vegetables on 40 layers of shelves two meters apart. That gives it about as much growing area as a 4,000 hectare farm. There is no winter in the building, and according to the *Yomiuri* article, it takes about a month to grow a head of lettuce, roughly half the time needed by field-grown lettuce, so the growing season is at least four times longer than a regular farm. There are no insects in the building, no deer, few rodents, no weeds, drought, or floods, and there is always the right amount of light and fertilizer, so little food is lost to spoilage. Automation is much easier. There are no rocks, hills or irregular areas, so robots can process the crops. Robots cannot work in the hills of Pennsylvania or the paddies of Japan. Overall, the 100 hectare facility is at least as efficient as a 16,000 hectare (40,000 acre) farm.

The total land area of the U.S. is ~917 million hectares. Forty seven percent, ~430 million hectares, are used for agriculture, including ~161 million hectares for crops.[30] The other 269 million hectares are used for livestock, including arid land not suitable for crops. Roughly a quarter of U.S. food is exported. Someday this agricultural land might be crammed into an area thousands of times smaller in giant complexes of buildings hundreds of stories high nestled in the Rocky Mountains, on the moon, or in some other location where land is cheap. Or, you could cover the five boroughs of New York City (800 square kilometers; 80,000 hectares) with buildings as tall as the World Trade Center towers (411 meters), which would produce as much food as ~66 million hectares of crop land, enough to feed about half the U.S. population.

As old fashioned two dimensional outdoor farms become obsolete, a tremendous amount of land will be freed up. It will be used for houses, or reforested and returned to nature. Agriculture is the most destructive industry on earth. It causes deforestation and erosion. It depends on pesticides and fertilizer. Monocultured crops reduce genetic diversity. The sooner farms are replaced by compact enclosed factories, the better it will be for the ecology.

People may object to food factories, regarding them as dehumanized or unnat-

New Energy Times Archive

ural. Farms and greenhouses look unnatural to me, but they are inviting places. It will be spring year-round in part of the food factory, with blossoms, honeybees, and bright artificial sunlight. Food factories in the far north will do a lively business during the winter hosting people hungry for a touch of spring, summer or fall, or all three the same afternoon. Acres of grass and trees might be set aside as a park, with artificial brooks and real fish.

In the distant future, indoor farms may be supplanted by food synthesizers. This will require new discoveries and new biotechnology. Cold fusion is likely to come into widespread industrial use long before these technologies can be applied radically, or traditional agriculture done away with altogether.

The Dangers of Cold Fusion

There are legitimate concerns about the dangers of cold fusion. They fall into two categories: radiation, and long term environmental threats from the irresponsible use of cheap energy.

Some scientists believe that cold fusion is not fusion *per se*, it is zero-point energy, or shrinking hydrogen atom 'super-chemistry,' or some other exotic phenomenon. Even if one of these hypotheses turns out to be correct, there is no denying that cold fusion includes a nuclear component. Cold fusion produces helium and transmutes cathode metals. Occasionally it produces tritium. Autoradiographs show that some used cathodes are radioactive. Perhaps these nuclear transmutations are a side-effect of zero point energy, or perhaps the "conventional" cold fusion nuclear theories are correct and the transmutations are the sole source of energy. Either way, nuclear reactions and radiation are inherently dangerous, and must be treated with respect. It would be foolish to treat a cold fusion cell like a solar cell or some other source of energy with no possible side effects. A cold fusion engine will not be as dangerous as an internal combustion engine, which requires explosive fuel and produces deadly carbon monoxide. But it *may* require some shielding, and possibly a radiation alarm that could trigger an emergency cutoff switch—unless the process could be *tuned* and *certified* not to produce ionizing radiation. A fully developed theory to explain the cold fusion reaction might give us pinpoint control, and it would give us increased confidence that cold fusion motors cannot produce large, uncontrolled bursts of radiation under any circumstances.

A cold fusion engine will not be as dangerous as an internal combustion engine....

Some people fear there may be a hidden, long term threat to the health of people who work in close proximity to cold fusion reactors. So far, nobody has detected dangerous levels of x-rays or other emissions from a cold fusion cell. The autoradiographs prove that cold fusion does produce low levels of radioactivity, but the levels are so low that scientists have difficulty detecting them with sensitive instruments. Compared to the radiation from televisions and the natural background of radiation from space, radon and other sources, cold fusion radiation seems likely to remain so low as to be nearly undetectable. Still, cold fusion might conceivably produce some unknown form of radiation or some other deleterious effect. We will have to make sure this is not the case, by exposing rats and other laboratory animals to unshielded cold fusion reactors, and by carefully monitoring the health of the first group of people who work with the reactors every day.

When cold fusion was announced in 1989, A. Lovins, J. Rifkin and others said they hoped it is not real because mankind would do great harm with such a powerful tool.[31] People compare cold fusion to giving a baby a machine gun. I do not understand this logic. We can easily destroy the earth with the technology we already have. We do not need cold fusion, nuclear bombs or any advanced technology. We are using fire, our oldest technology, to destroy the rain forests. The ancient Chinese, Greeks and Romans deforested large areas and turned productive crop land into desert. The destructive side effects of technology in 2000 BC were as bad as they are today.

Cold fusion could become a powerful force for evil. Used unwisely, or with malice, it could exacerbate social problems ranging from boom boxes to unemployment and environmental destruction. But that is true of every technology. Unless it can be used to make cheap nuclear bombs, cold fusion will not threaten our future any more than fire or automobiles already do. If people act irresponsibly, and laws are not established to protect the ecosystem, we will end up destroying the earth no matter what tools we use. Our only hope is that people will act wisely, and they will treasure and protect nature. That job will be far easier with nonpolluting cold fusion. We can use this wonderful new tool to eliminate pollution and clean up the earth if we choose to, or we can destroy everything with it. It is up to us. Our destiny has always been up to us.

Footnotes

1. A. C. Clarke, *Profiles of the Future*, (Bantam, 1972) p.144
2. R. Levine, "Sun," *Microsoft Encarta*, 1996 edition; 3.8×10^{33} ergs/sec
3. Hydrogen Program Plan FY 1993 - FY 1997, US Department of Energy, NREL, June 1992, Appendix A
4. An internal combustion engine can be combined with a generator and battery to solve this problem. This is how a diesel - electric railroad locomotive works. This also allows effective regenerative braking. An experimental automobile works on similar principles. See: A. Pollack, "Toyota to Sell Hybrid-Power Car in Japan," *New York Times* March 26, 1997
5. Interview with NASA scientist, National Public Radio, November 23, 1996
6. Private communication, R. Machachek, Product Manager - Heavy Water, Ontario Hydro
7. Refinery use and loss account for 11 million barrels per day out of 59 million total production. See: G. Davis, "Energy for Planet Earth," *Scientific American,* September 1990, p. 59
8. G. Davis, ibid.
9. R. Stobaugh, D. Yergin, "Energy Supply, World," *Microsoft Encarta*, 1996 edition
10. Sources: R. Petrasso, *Nature*, 350, (1991) 661; private communication R. Heeter, PPPL, and B. Merriman, UCSD
11. A. C. Clarke, ibid, p. 155
12. E. Storms, "How to Produce the Pons-Fleischmann Effect," *Fusion Technology*, March 1996
13. A. Fickett, "Efficient Use of Electricity," *Scientific American,* September 1990, p. 66, citing an EPRI study
14. W. Baker, "The Hull," *The Lore of Ships,* (Holt, Rinehart and Winston, 1963), p. 19
15. D. Ford, *Three Mile Island,* (Penguin Books, 1982), p. 115
16. J. M. Unger, *The Fifth Generation Fallacy,* (Oxford University Press, 1987)
17. Hydrogen Program Plan FY 1993 - FY 1997, US Department of Energy, NREL, June 1992, Appendix A
18. Price quote from Intelligen Energy Systems, Inc., 98 South Street, Hopkinton MA 01748
19. A. C. Clarke, ibid, p. 148 - 149
20. Http://www.mmt.com.21. S. Florman, *Blaming Technology*, (St. Martin's Press, 1981), p. 15
21. S. Florman, *Blaming Technology*, (St. Martin's Press, 1981), p.15.
22. J. McPhee, *The Deltoid Pumpkin Seed*, (Farrar Straus & Giroux, 1981), originally published in the New Yorker Magazine, 1980
23. E. L. Andrews, "60 Years After Disaster, A Zeppelin Is Set to Fly," *New York Times*, April 22, 1997
24. D. Eisenhower, *Crusade in Europe*, Doubleday & Co., 1948, p. 164
25. F. Dyson, *Weapons and Hope*, (Harper and Row, 1984), p. 47
26. Private communication, 1993
27. "Shokubutsu koujousan no yasai ga ninki," ("Food factory-grown vegetables are popular"), *Yomiuri Shimbun*, January 16, 1994
28. R. B. Woodward, "Business is Blooming," *New York Times magazine*, May 9, 1993
29. H. B. Herring, "900,000 Striped Bass, and Not a Fishing Pole in Sight," *New York Times*, November 6, 1994
30. "Agriculture," *Microsoft Encarta*, 1996 edition
31. E. Mallove, *Fire from Ice*, (Wiley, 1991), p. 86

New Energy Times Online

Fusion Reactors Shipped to New Hampshire and the UK —A Milestone in National and International Commerce

On April 22, 1997, Cold Fusion Technology, Inc. (publisher of *Infinite Energy* Magazine) took delivery at its Bow, New Hampshire offices and North American laboratory of what may have been the first commercial shipment of cold fusion reactors. The reactors were sent Fedex by engineer Evan Ragland, inventor of these triode configuration reactors. His company is *The Boilerworks* of Diamondhead, Mississippi. Issue #10 of *Infinite Energy* carried a story about Ragland and his reactor design. We were instrumental in pushing Evan to get his cell into a manufacturable, demonstration unit form.

Sure IMRA Europe, SRI international, CETI, and the like have been shipping experimental cells for years between laboratories, but this is the first case (as far as we know) in which reactors were *purchased* for testing with the expectation that said reactors would, in due course, produce an Output/Input power ratio of 3/1 to 5/1 at the multi-watt level.

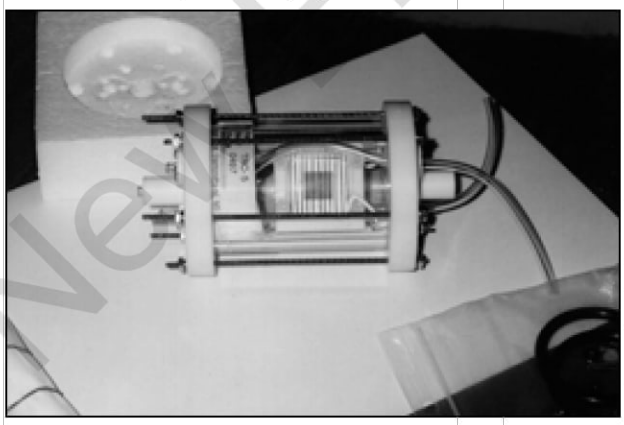
Reactor TRC-5 is mounted in its test-bed here in New Hampshire. TRC-6 was Fedexed the very day of its receipt from Diamondhead to our Nottingham, UK office, where engineer Christopher Tinsley was preparing his experimental validation set up, even as we here in New Hampshire had begun to do. As we went to press in early May (for this "nominally" January-February issue—we'll catch up this year, we promise!) tests in the UK were set to begin within days. In New Hampshire, we will be able to initiate testing around the time that the magazine arrives back from the printer. Issue #12—out in June, we trust— will definitely have a status report on what we find.

At the moment, we are trying our best to adhere to the precise protocol that Ragland has given us. He has told us repeatedly that he firmly expects us to be successful. That is what our experimental program intends to find out. If the results are disappointing, we will publish those too and then work with Evan to find out what we may have been doing improperly. The rectors are set-up for quick interchange of the specially-made palladium cathodes, so it will be possible to perform iterations fairly rapidly.

TRC-5 and TRC-6 arrived safely in New Hampshire in one of the best-designed shipping containers we have ever seen.

If, as expected, significant excess power emerges, as four previous prototype reactors by Ragland have reportedly evidenced, we here at Cold Fusion Technology, Inc. (or at new New Hampshire company specifically set up by us to do this) will, under a license from Evan Ragland's company, begin to manufacture and market these demonstration reactors. We intend to provide some versions as turn-key systems, complete with data acquisition systems. Other reactors will be provided in "bare bones" form. This will be a wonderful and hopefully rubust embodiment of the heavywater-based Pons/Fleischmann process. Others, also working with Ragland, are aiming to scale up the basic triode configuration to make a 2-kilowatt heating unit—but that product is certainly not "right around the corner."

About the price of the demonstration cells—"funny you should ask"! There is no set price structure, as yet. The first two prototypes were very expensive (for our bank account), but essential to start the development rolling. A lot will depend on the market interest, which we think will be very big. So, if you, your company, or bold university physics, chemistry, or engineering department might consider acquiring a research reactor—*under a performance guarantee*—please contact us by mail or fax as soon as possible, stating your intentions.



TRC-5 shown on its side with one platinum anode array visible. The masked-down palladium cathode with special preparation is the small square.

The purpose of this demonstration cell activity will be to provide accessible research tools to industrial and university laboratories around the world. This will have the important side benefit of spreading the news about the reality of the cold fusion phenomenon. We have been told, for one thing, that if the French Atomic Energy Commission were to get one of these units (at 3/1 to 5/1 power ratio) in its hands, based on the work that Biberian and Lonchampt have already done, it would trigger a massive burst of interest.

Note well, this is not the only demonstration unit we are considering to market. A number of other prospects may be close at hand. This field, as our regular readers know, is full of surprises. The pace is quickening. We are not in Kansas anymore!

In a letter to our Associate Editor, Hal Fox in Salt Lake City, Evan said the following:

"Your ongoing interest in my work with the cold nuclear fusion triode is appreciated. Presently, there is no exciting experimental work to report from our laboratory. Since Sapporo, triode consultation to other laboratories occupies most of my time. We are designing the preferred embodiment of the apparatus, a tubular cathode triode. Martin Fleischmann is working with me on cathode design for this cell. Hopefully, there will be results to report on this experiment later this year

"In the meantime. I am happy not to wet my hands with heavy water but to encourage others to experiment with the triode. Three-electrode control should enable us to overcome the 'reproducibility problem' which has so plagued cold fusion experiments. There is much still to be learned about this apparatus. For, like two previous three-electrode inventions, the vacuum tube triode and the transistor, it is in the beginning a very crude appliance."

New Energy Times Archive

Dr. Randell Mills and the Power of BlackLight

by Eugene Mallove

Dr. Randell Mills and BlackLight Power, Inc. of Malvern, Pennsylvania (see *Infinite Energy* #11, page 56) are very much in the news. Unfortunately, NOT (*yet*) in those traditional media such as *The New York Times*, *The Wall Street Journal*, or *Business Week*, but on the Internet—the World Wide Web. If the traditional media *dared* to cover the emerging technology of BlackLight Power, or of "mainstream" cold fusion for that matter, and "call a spade a spade" instead of eternally bowing to the naysayers—the energy moguls of this planet would be shaken out of their smug complacency.

We urge you to examine the very impressive Web page:

http://blacklightpower.com

of BlackLight Power, Inc. You will learn a tremendous amount about the Company: its financial plans, its experiments to verify massive excess heat production in advanced hydrogen gas cells, the fine credentials of its directors, details of astrophysical observations of spectra that suggest the validity of the Mills theory of catalytically shrunk hydrogen, an excellent story that recently appeared on the Reuters wire service (but which has been picked up by *none* of the high-profile mainstream media). This and much, much more than this brief review could possibly tell you. We'll just mention a few highlights for now, but in the future there is little doubt that BlackLight Power, Inc.—formerly Hydro Catalysis Power Corpora-tion— may be destined for some great things.

I first heard of Dr. Randell Mills in May of 1991, when I was still at MIT and just as *Fire from Ice* was being published. Then, the announcement of his forthcoming paper in *Fusion Technology* on excess energy in ordinary water electrochemical cells and his theory of sub-ground-state hydrogen shocked the cold fusion community. It initiated what Prof. Robert Bush (in this issue of *IE*) calls the "light water revolution" within cold fusion. There have been many, many verifications of the Mills work, including one by a NASA laboratory (see *IE #7*).

The claims of excess energy—far beyond normal chemical energy—from ordinary water cells with nickel cathodes and potassium carbonate electrolyte, has been slowly accepted by many in the cold fusion community. The existence of the prominent Patterson Power Cell (of CETI) is proof of that. Unfortunately, there are still some holdouts even in the CF community—further evidence of the power of stodgy scientific thinking among even the most enlightened practitioners on the planet!

Mills and Co. have now abandoned water-based electrolytic cells in favor of high-temperature hydrogen gas cells, which the company claims put out from 100 to 1,000 times the energy of ordinary hydrogen combustion with oxygen. These cells apparently use a two-stage catalytic process to accomplish the production of the shrunken hydrogen atoms, which Mills has dubbed, "hydrinos." Part of the process uses hot filaments and another stage may embody a low-pressure, potassium-containing gaseous catalyst (potassium iodide?) introduced into the low-pressure, hot hydrogen vessel.

Incidentally, the hydrinos, if real as Mills' and independent data suggest, would not be environmentally dangerous, BlackLight claims. Being atomic hydrogen, they would ultimately rise in the atmosphere and waft off into space. Obviously the electricity necessary to run the process could be obtained from a small fraction of the thermal energy released.

Mills said to Reuters, "Whoever has this technology can potentially dominate the energy industry." We can certainly believe that, though we would prefer to see ***live*** demonstrations of those cells (and the ***sale*** of demonstration units) rather than discussions of data an theory—*that* would certainly break the logjam! In the meantime, other companies are working feverishly with competing systems. For example, CETI has an electrolytic system (which may be shown at the ANS meeting in Orlando, Florida, June 1-5) that is reportedly continuously putting out hundreds of watts of excess power. True enough, gas cells offer thermodynamic efficiency advantages if they are at the 500 °C — 1,000 °C range that BlackLight is touting. And ENECO claims to the press that it too is working on a high-temperature gas cell. All this is reminiscent of the Piantelli et al work in Italy, for which IE published the relevant patent. But Piantelli of the University of Siena, working with Fiat we understand, has not been heard from since 1995 (see *IE #4*).

Dr. Randell Mills (L) with Dr. Edmund Storms (next) and others (from hot fusion) testify at the Fusion Energy hearing before the House Science, Space, and Technology Committee, May 5, 1993 *(Courtesy, Gene Mallove)*

As for the financial support behind BlackLight Power, we learn that Atlantic Energy, Inc. is considering investing in the company, based on tests by Peter Jansson, an engineer and manager of market development. The Reuters reporter found that Oregon-based holding firm, PacificCorp has invested $1 million in BLP. Reading Energy Co. of Philadelphia is considering involvement.

Most impressive is that Dr. Shelby Brewer, a former US Department of Energy Assistant Energy Secretary (during the Reagan Administration) and a former head of ABB Combustion Engineering, is now fully behind BLP as a financial advisor. We learn from the WWW that Brewer traveled with Mills to Korea to establish business contacts.

Since Dr. Mills with his "Grand Unified Theory of Classical Quantum Mechanics" is firmly of the opinion, on theoretical and experimental grounds, that the excess energy of "cold fusion" cannot be of nuclear origin, what then has BlackLight Power to do with cold fusion? More, I suggest, than he may believe. It is getting increasingly difficult to deny the massive appearance of transmuted elements in cold fusion. Witness the three outstanding contributions in this issue of Infinite Energy: the historically pioneering work of Bush and Eagleton in light water systems finding calcium apparently transmuted from potassium, the work of Hora, Kelly, and Miley in defining the transmutations that have been observed in CETI cells, and not the least, the bombshell by Arata and Zhang—the detection of massive quantities of helium-4 and helium-3 in

Continued on page 35

The Saint Comes Marching In.....

Excitement built as *The Saint* came marching into towns and cities all across the United States. By now, the techno-thriller with cold fusion as its central theme, has made it across "The Pond"—an ocean of fuel for an energy-hungry global civilization—and is being shown in Europe. Soon it will be elsewhere...everywhere.

It is hard to imagine a dry eye among the embattled cold fusioneers who paid for their tickets to *The Saint* (see *IE#*11 for more background). The lavishly filmed movie opened on April 4, 1997. It had been scheduled for a March 14th start, but the folks at Paramount Pictures, which had paid a reported $65,000,000 on the movie, wanted optimum placement among all the other new-release films. It is very difficult for *anything* to compete with *Star Wars!*

We can tell you that we received numerous breathless calls at the *Infinite Energy* office from excited well-wishers. They knew that your dear Editor had pulled a few strings to make the show put cold fusion in the very best light. It had already been very well treated in the original script.

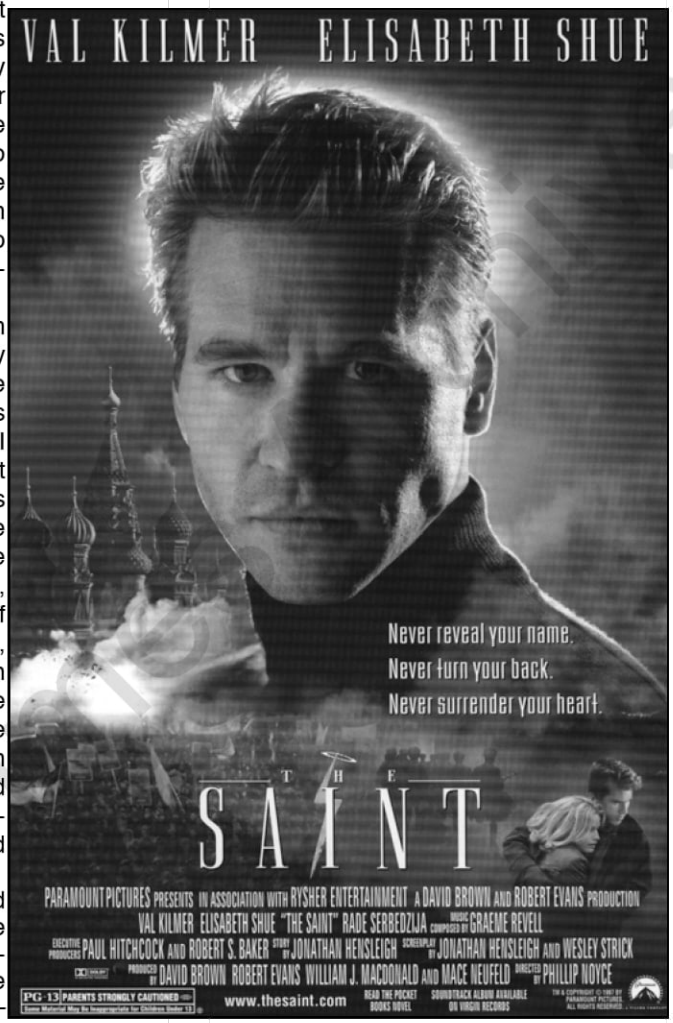
Yes, it was great to see a few of Mallove's and Jed Rothwell's lines uttered—word-for-word—by Elisabeth Shue! No, it was not Gene who suggested where those CF equations by MIT Professor Peter Hagelstein should be placed!! But I *did* cut up copies of some of Peter's theory papers and dispatched them to Paramount, with the admonition that they should be thickly disguised. Let's say, for those of you who have already seen the movie, this lovely actress *really took them to heart*, safeguarding them in a very special place!

Oh, and it was wonderful to see the triumphant, eerie beam of light shoot skyward at the end, powered by an extra-hot cold fusion reactor. I told them how to kludge up a few likely-looking things to make that scene—influenced a bit by the still mysterious process of the Cincinnati Group (Morningstar), the tile-melting process. Yes, the Russian extras in the film were praying— as well the rest of us might— in joy for the success of this new form of energy.

I am sure there are quite a few hot-fusioneers, about to be booted out of their obsolete jobs, plus other characters in the physics establishment who are appalled at the money spent on a movie about (they say) "pathological science." Why, they may be thinking, couldn't such funds be transferred to *their* pet projects. I note that its makers will spend more money on *The Saint* than the MIT Plasma Fusion Lab rips off from Uncle Sam in just two years. (Princeton's TFTR tokamak recently closed, but the US taxpayer will still be stuck with the multi-million-dollar bill to clean up the mess made when radioactive tritium was introduced a while ago in a last gasp for a PR triumph.)

Some may say the film was a bit "hokey," or they might not have enjoyed the acting—I thought it was *wonderful*, but of course I am biased. What rings out loud and clear, however, is that the words and the HOPE "cold fusion" are now firmly emblazoned, once again, in the minds of millions of average citizens, who wouldn't know fission from fusion. Of course, we in the field know that the science IS real. But for an obstinate, blind media and corrupt scientific establishment, the concept would now be general currency.

One person from a cold fusion company told me he went to see the movie several times, the second time *just to listen to the comments by theater-goers*. He said that he heard mumblings like "Why can't they let this technology happen?" Clearly, some of the public may smell "conspiracy" against CF— and they are not far from the truth. Just look at the antics of DOE's tireless hatchetman Huizenga in traveling to Cal Poly Pomona to blast cold fusion as "pathological science." (See the story on page 23.) He couldn't even look an operating cell in the eye! Off to Lawrence Livermore Laboratory he went, presumably to collect fees for some very worthy nuclear project of our government.



Well, we trust that in due course, *The Saint* will be looked back upon as a historic movie. It came out right at the time when cold fusion and new energy were beginning their run on the home stretch toward tangible, commercial products. We are very proud to have played even a small role in this fine movie. PLEASE DO GO AND SEE IT! Then buy the VHS tape when it comes out. This is certainly *NOT* the last cold fusion movie to be made, as Professor Keith Johnson, formerly of MIT, well knows! He's coming out with his own masterpiece— *Breaking Symmetry*. It has already been filmed. We'll keep you posted.

— *EFM*

**(ABOVE) Val Kilmer and Elisabeth Shue star in Paramount Pictures' *"The Saint"*
—Photo by Stephen Morley**

The Cold Fusion Cell that Made Huizenga "Blink"

A Visit to Cal Poly, Pomona, by John Huizenga, Arch-Critic of Cold Fusion

On Friday, February 28 of this year Dr. John R. Huizenga, author of the book *Cold Fusion: The Scientific Fiasco of the Century* and widely recognized arch-critic of CF ("cold fusion") visited Cal Poly, Pomona, (California State Poly-technic University), at the behest of the Cal Poly Physics Department chairman to present a seminar, "The Cold Fusion Fiasco." During the visit, and before his seminar, he insisted on visiting the cold fusion laboratory of Dr. Robert Bush and Dr. Robert Eagleton, both full professors in the Department. When confronted with an ordinary water electrolytic cell claimed by Bush to be an excess heat-producing "live cell," Huizenga was suddenly thrust into a situation which, based on his own public pronouncements, had to be absolutely unique for him. Huizenga has claimed that he had never been to a laboratory where (while he was there) the scientists claimed to have a live CF cell generating excess power. That Huizenga had been the powerful co-chairman of the Department of Energy's 22-member ERAB Cold Fusion Panel in 1989, which has been the key instrument used to deny government funding to CF researchers in the United States, makes this encounter particularly poignant— as will be seen from the following interview with theoretical and experimental researcher Dr. Robert T. Bush.—*EFM*

IE: ***Prof. Bush, how did Huizenga's visit to Cal Poly, Pomona, come about?***

RB: Several months before Huizenga's visit for his seminar on February 28 of this year, Dr. Eagleton and I were informed by our Department Head, the Physics chair, that the chair had personally invited Huizenga with the idea of getting the "other side of the story" on CF. The chair had read Huizenga's potboiler, *Cold Fusion, the Scientific Fiasco of the Century*, and found that Huizenga was available to give seminars.

IE: ***Shouldn't your department head have consulted you and Professor Eagleton, since you two have done so much in the field of CF and are widely known in the CF community for your work?***

RB: When I first heard of the planned visit, which had been set up *without any consultation with Eagleton and me*, I admit to initially having been somewhat resentful. A number of colleagues outside the Physics Department expressed to me their considered impressions that the chair had acted "unprofessionally." When I asked my chair directly about this invitation, which had reflected no input from us, he responded that, since the Department had heard one side of the CF story from us, why shouldn't the department get to hear the other side of the story? Well, as things have turned out, I am glad that he *did* invite Huizenga.

IE: ***How well had the two of you known Huizenga prior to his visit?***

RB: Huizenga has been to several of the International CF Conferences. *[Editor's note: Only to ICCF #1, #3, and #4, as far as is known.]* I remember seeing him at the Nagoya (ICCF3) and Maui (ICCF4) Conferences. He also entered into the social activities connected with these conferences. Personally, I have found him to be a very likeable fellow. Huizenga certainly seems to have the knack of being able to naysay most people without raising their blood pressure, which I find to be a social skill bordering on the unbelievable. I remember that when I first reproached him for the title of his book, *Cold Fusion: The Scientific Fiasco of the Century*, he hastened to assure me that he was not referring to work of scientists in CF like myself, but rather the book referred to the contretemps surrounding the initial Pons-Fleischmann revelations. Certainly Huizenga is far and away the most personable of the CF critics. Had John not initially shown considerable talent for Physics and Chemistry, I believe he could have been a remarkable salesman. In fact, I believe that he and his ERAB Committee sold our government, and the Department of Energy in particular, a "bill of goods."

IE: ***Could you tell us now about Huizenga's visit to your laboratory and the sort of exchange that took place?***

RB: The Physics chair had informed me at least three weeks in advance that Huizenga would want a tour of our Cal Poly, Pomona, CF laboratory. I am sure that it must have occurred to me that it would be interesting to have at least one cell in operation at the time of his visit. On the other hand, we have our own agenda of research and I was not highly motivated to deviate in any significant fashion from that. In addition, we have many proprietary aspects now associated with our work, and this bothered me somewhat.

I was in the lab when John showed up there with my department head around 3:00 pm, approximately one hour before his scheduled seminar. (Eagleton was ill that day with the flu and was at neither the lab visit nor Huizenga's subsequent seminar.) Huizenga is a friendly fellow and bounded over to shake my hand while flashing a big smile. After this greeting, I asked him to sign a standard sort of non-disclosure agreement. However, he protested that he had never had to sign such an agreement on any of his other laboratory visits and was not about to start at this juncture. Thus, had I not decided to waive this requirement, the tour would have ended before it started. Now, two things suddenly occurred to me essentially simultaneously. (1) Huizenga had stated publicly that he had never been to a laboratory where the researchers) claimed to have a live CF cell producing excess power; and (2) We just happened to have a new experimental cell that was running

Had John not initially shown considerable talent for Physics and Chemistry, I believe he could have been a remarkable salesman.

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and evidencing excess power. And, while the gain (P_{out}/P_{in}) was rather modest at that time (about 1.12) the excess power was well outside the possible error bars, according to our measurements. Thus, while I had been reluctant initially to permit Huizenga's visit to our laboratory, because of proprietary aspects, it now occurred to me that a rather interesting situation was developing, namely, Huizenga's first encounter with a live cell. (Of course, why this should be when Huizenga's Committee was charged with making a *thorough* investigation of CF, is a very good question.) We advanced to the hood section of the laboratory to observe the cell. Huizenga stared at the cell asking me whether it was being run in a "closed" or "open" mode. I indicated that we had run with *both* types of cell before, but that this was an open cell. He then indicated his opinion that a common error in open mode operation involved unrecognized recombination of hydrogen and oxygen within the cell with a concomitant unrecognized energy release. Thus, if the entire (1.48 Volts x I) term has been subtracted from the input power this would constitute a spurious source of excess power. However, it became clear that, in the voltage range that I was working in, this could not possibly be making a significant contribution to the excess power. My department head nodded his agreement with this.

Shortly after this exchange, I invited Huizenga to take data with Eagleton and me, indicating that he could take as much time as he liked. I told him that, if he could show me an error in our work leading to a significant spurious excess power, I would not spend another minute in CF. At this point Huizenga noted that he is "retired." My reply was; "Perfect, you have all the time in the world to do this investigation." Moreover, I opined that we could probably even provide him with a fellowship to cover his expenses for this investigation. At this, he backed off, indicating that he was not totally retired but, in fact, was doing some consulting for the Lawrence Livermore Laboratory up north in the Bay Area. "Perfect," I exclaimed, "since this will get you over to the West Coast from your retirement home in North Carolina." ***At this juncture I could have sworn that I saw Huizenga actually blink!***

IE: ***Could you comment on Huizenga's seminar?***

RB: Huizenga did a rather good job of marshalling the standard, but shopworn as far as the CF community is concerned, arguments employed against CF. Thus, unlike many in the audience of roughly fifty students and faculty, I heard essentially nothing new. However, if one had never heard the case made against CF, and had received no "immunization," Huizenga's talk must have seemed to be an absolutely withering, and well-deserved, attack upon CF. As a veteran of the "CF wars," I can say that the "evidence" adduced against CF consisted of the usual grist, including the now invalid argument of a lack of nuclear evidence for fusion. However, even before the isotope evidence, that argument was moot. Thus, from the very beginnings of CF in 1989, it was clear that the nuclear reactions could not mirror the two-body d-d reactions taking place in a Tokamak. At the rate of excess heat production on the order of a watt, the researchers would have expired due to the attendant fluxes of gammas and neutrons. This paradox was, in fact, referred to as "the dead graduate student problem." Many CF researchers, and notably Julian Schwinger, pointed to the difference between the intermetallic environment of CF and the vacuum environment for Tokamak hot fusion nuclear reactions. And, this is notwithstanding arguments based upon timescale, since the reactions, as Dr. Hal Puthoff observes, need only obey the uncertainty principle. Thus, CF in my estimation will turn out to be only the latest surprise in a long line of surprises in the unfolding of Quantum Mechanics. Another example of such surprises is the phenomenon of "high-temperature superconductivity." That is to say, Quantum Mechanics is hardly complete. Also, so much for the so-called "end of science," when the ongoing unfolding of Quantum Mechanics is capable of such Byzantine twists and turns— including the inducement of essentially wholesale bafflement within the Physics community.

I told him that, if he could show me an error in our work leading to a significant spurious excess power, I would not spend another minute in CF.

IE: ***What to you is the significance of Huizenga's encounter with the live CF cell in your lab?***

RB: Huizenga was co-chair of the important 1989 ERAB Cold Fusion Panel, charged with investigating CF for our government and making recommendations regarding government funding of the CF research in this country. Huizenga's committee had an awesome responsibility. Just how awesome is now beginning to emerge from successful studies, including those at Cal Poly, Pomona, by the decimated field of CF researchers. Huizenga's Committee recommended against funding, which accounts for the decimation of the field. Now, while it is impossible to know what the progress of CF research and development would have been in the case of a positive recommendation by Huizenga's committee, it can reasonably be surmised that we would almost certainly be considerably further along the track than we actually are at this point in time with CF. Because of his great responsibility in this judgment. I am very disappointed, but hardly surprised, that Huizenga showed no interest in investigating our claim at Cal Poly, Pomona, of a live cell. He does not want to see anything that will upset his present view of the physical world. This is the modern day equivalent of the Aristotelian philosophers refusing to look at the moon through Galileo's telescope, or of their claiming that the mountains and craters claimed by Galileo for the moon were simply artifacts produced by the telescope. In my estimation his responsibility towards this country has not ended. For that reason, and simply for the sake of his own intellectual curiosity and honesty, he cannot afford to ignore this small live cell in our Cal Poly, Pomona, laboratory.

Huizenga's committee had an awesome responsibility. Just how awesome is now beginning to emerge from successful studies....

IE: Finally, what message would you like to have conveyed to Huizenga.?

RB: In one short paragraph I guess that I would like to say the following: John, everyone in the CF community wishes you a pleasant, if intellectually-unsettled, retirement in North Carolina. There has, in fact, been an obvious positive side to your criticism from my point of view. I refer here to your monumental efficacy in helping to keep competitors, such as Cal Tech and M.I.T. away from this field of research. This has allowed a number of us to achieve meaningful niches. For this, John, I am eternally grateful. Now, you indicated during your visit here that your retirement residence [in Pinehurst, NC] is adjacent to some of the North Carolina's best golf courses. Let me assure you that the "rough" for your negative verdict, coming

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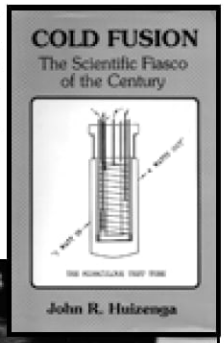
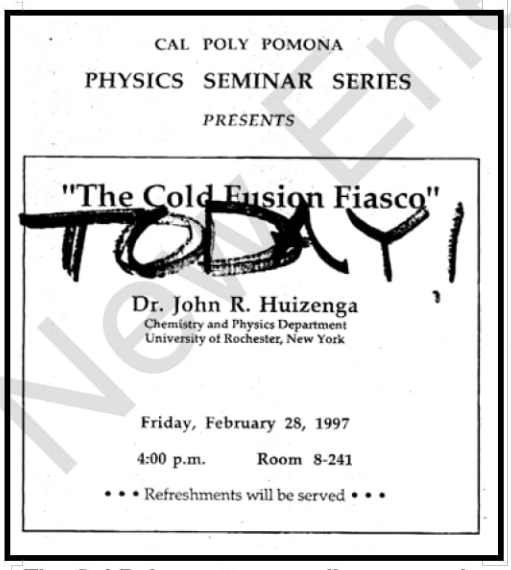
soon in the development of CF, will figuratively dwarf the rough adjacent to these new fairways. Also, the cell shown you in our laboratory at Cal Poly, Pomona, your first "live cell" as you yourself put it, has shown a significantly-enhanced performance since your visit. Our invitation to take data with us is still open. Can you afford to ignore the challenge of something that is claimed to presage the next major source of energy for mankind? Looked at in a more personal way, these developments are, thankfully, just in time to offer a better world for your grandchildren in terms of a pollution- and radiation-free environment.



Prof. John R. Huizenga, Circa 1989
(Courtesy, University of Rochester)


CAL POLY POMONA
PHYSICS SEMINAR SERIES
PRESENTS

"The Cold Fusion Fiasco"
TODAY!

Dr. John R. Huizenga
Chemistry and Physics Department
University of Rochester, New York

Friday, February 28, 1997
4:00 p.m. Room 8-241
• • • Refreshments will be served • • •

The Cal Poly poster proudly announcing Huizenga's lecture *(Courtesy, Prof. Bush)*

The Pioneering Cold Fusion Work of Dr. Robert T. Bush

Physics Department, the California State Polytechnic University
3801 West Temple Avenue, Pomona, CA, 91737

Professor Bush has answered questions in two separate interviews in this issue of* IE. *One of these (facing page) is an interview about the recent visit to his university, Cal Poly, Pomona, by cold fusion arch-critic John Huizenga. (A short sidebar—a preview of coming attractions in future issues of IE, probes aspects of the live CF cell that Huizenga encountered in the laboratory at Cal Poly, Pomona.) The interview that follows focuses on Prof. Bush's work in cold fusion. It includes his personal views of the field and how it has unfolded. There is a list at the end of the interview, kindly provided by Dr. Bush, organizing his many theoretical and experimental accomplishments in CF. Also included is an "exclusive" research paper, aimed at the layman portion of the IE audience. Prof. Bush emphasizes that the views expressed here are his own, and do not necessarily represent the views of either his Department, The College of Science, or Cal Poly, Pomona. (Prof. Bush may be reached at the above address, but not by e-mail at this time.)—EFM

IE: ***You are, of course, known to the CF community both for your experimental work in "cold fusion"—CF— in collaboration with your colleague at Cal Poly, Dr. Robert Eagleton. You are also known for your theoretical work in CF. How did you get started in the field?***

RB: In early April of 1989, shortly after the Pons/Fleischmann (Hereafter: P&F) announcement, Eagleton and I found ourselves reading a newspaper item on CF posted on the door of a colleague in Physics. The prospect that this phenomenon might exist was intriguing and begged the question of a potential explanation. Essentially, on the spot, we decided to collaborate in an attempt to probe this burning question. Our collaborative experimental work began during that summer, shortly after the Santa Fe Conference on Cold Fusion in May of 1989.

IE: ***How do the two of you divide up the work within the Cal Poly (Pomona) CF Group?***

RB: First, let me applaud your mentioning my experimental work, since many, knowing my theoretical work, may have concluded that I am the theorist, while Eagleton is the experimentalist. In fact, most of what I do in connection with the CF Group at Cal Poly, Pomona, beyond my extensive teaching duties, involves experimental research. My theoretical ideas and models, (TRM, CAF, LANT etc.), have guided the experimental work that we do. And, since Eagleton is much better at the apparatus-building than I am, it made sense to let him do that with design feature input from both of us, with the design focussed upon experiments to check the theoretical work. Moreover, because we must both teach twelve units a quarter in the Physics Department (typically two lecture courses and three laboratory courses), apparatus- building takes up a considerable amount of Eagleton's spare time. In addition to theorizing, I collect the data and analyze it with considerable attention paid to a comparison with the theoretical predictions. It has been natural for me to take the lead in the experimental work, because my theoretical work provides very specific questions to answer. To get the cells to "talk" to us, to answer these questions, often requires unique design features. I hasten to add that Eagleton, as well as being the builder, also functions as a sounding board for the data and the results of my analysis of that data. Without question, I am fortunate to be working with such a talented physicist. Clearly, we have been successful in experimental CF research because each of us has talents that complement those of the other.

One of my proudest moments was at a CF Conference several years ago when John Bockris, "Distinguished Professor of Chemistry at Texas A & M," told me privately between sessions that "the Cal Poly (Pomona) Group is the best group in Cold Fusion." Coming from so distinguished a professor and researcher as Bockris, who is one of the genuine heroes in the development of CF, this was a considerable accolade.

IE: ***Has Cal Poly, Pomona, supported you in this project?***

RB: The CSU (California State University)

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system is presently not a wealthy system, such as the University of California System, the next tier up, which would seem to belie our official nickname of "the Golden State." (I underline "presently," since I am hoping to change this relative financial situation with the help of cold fusion. Ha!) Nevertheless, there has been both moral and financial support. In connection with the latter, the College of Science has the policy of matching money brought in for "release time" from teaching to do research—on a dollar-per-dollar basis. This has been tremendously helpful because of our tremendous teaching load of twelve units per quarter. Thus, in order to have time for significant research activities we must essentially "buy our way out" of a portion of our courses. Both the dean and associate dean have been reasonably supportive, although the dean is relatively new on campus and, as might have been anticipated, had heard only negative things about CF prior to coming to Cal Poly, Pomona.

At a campus of the University of California system I would have to teach only two to three courses a year in contrast to my present load of about fifteen courses a year. On the other hand, the *negative* peer pressure that could be brought to bear against CF would make it very difficult at this juncture to pursue CF research there.

IE: ***Have your colleagues been supportive?***

RB: Most of my colleagues in Physics have remained essentially neutral. By this I mean to imply that they try to *appear* objective when talking to me. To many of them, it is now, unfortunately, an open-and-shut case. This, of course, simply mirrors the general situation within the Physics community. [A sociologist of science recently indicated that if only three or four of the top names in a field of science come out against a topic such as CF, the remaining members of the "herd" take this as their "charge." (No pun intended.)] Thus, Huizenga's visit also marked the first time that our Department chair had visited our CF laboratory! The previous chairman *never* visited, even though there was a six-year overlap of his chairmanship and our CF research. From private reports, I have heard that a number of my colleagues think that I have gone at least "a wee bit around the bend" in this matter of so-called "cold fusion." Colleagues in other areas of Science, Engineering, and the Humanities tend to be much more open minded about CF.

All things considered, however, my colleagues in Physics have been rather nice to me. I would like to think that I would react as well were the shoe on the other foot, but I am not so sure.

Huizenga's talk at Cal Poly did real harm to our acceptance from some colleagues who had not previously been subjected to such a barrage of negativity. Nevertheless, I have not met the bad treatment meted out to say Prof. Peter Hagelstein at MIT. And, of course, no one has been treated as badly as P&F who have, at least in essence, been "martyred." For me, the negativity has been quite acceptable, considering the joy and other positives that CF has brought into my life. For this I now thank P & F from the bottom of my heart. May their martyrdom be relatively brief, as recent developments are leading me to believe.

Of course, the flip side of the Physics community's negativity is that it has kept institutions such as Cal Tech and MIT from swarming all over this problem. That attitude has allowed a number of us to create significant niches for our own CF research. For this I thank Huizenga. If my Shakespeare serves me here: "It is an ill wind that does not blow somebody some good."

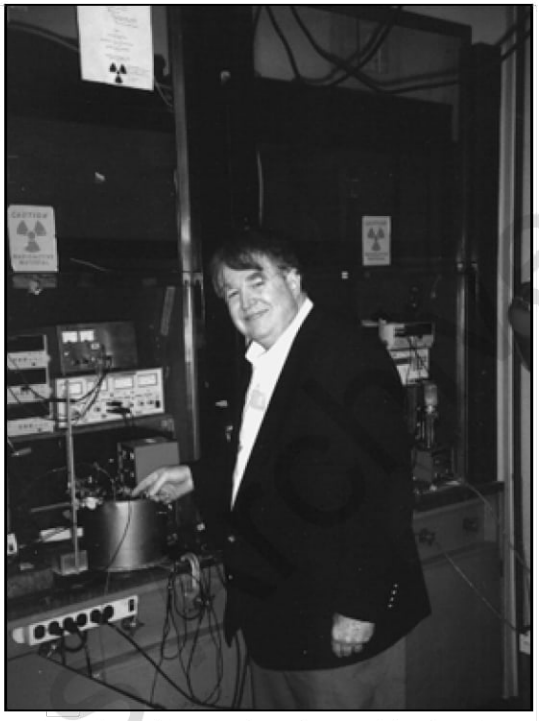
IE: ***Could you have worked in this research area had you not had tenure at the time?***

RB: Absolutely not! I am sure that this is Eagleton's attitude, also. We both have dependents, and CF research on our part would have been a definite liability with regard to both job continuance, tenure, and promotion. The survival of unpopular, or "orphan," science which often makes breakthroughs benefitting this country, and the general betterment of mankind, is one of the very best arguments in support of tenure.

Colleagues in other areas of Science, Engineering, and the Humanities tend to be much more open minded about CF.

IE: ***Have students helped with the project?***

RB: We have no Ph.D. program or Master's degree program in the Physics Department as yet, so the students who have helped are all undergraduates. One exception is my oldest son, Roger, who was a graduate student at the University of California when he adapted the commercial Lab View™ computerized data recording system to our particular laboratory setup. Eagleton was quite amazed that Roger had taken no courses in Electrical Engineering as background for that project.



Prof. Robert T. Bush in the cold fusion lab at Cal Poly, Pomona ***(Courtesy Prof. Bush and Prof. Eagleton)***

Students also occasionally help us with number-crunching, and serve as technical staff. Our present student helper, James Djunaedy, an ethnic Chinese person from Semarang in Central Java, Indonesia, is pictured in this article. James, in fact, put together the electrolytic cell which I showed to Huizenga. (This cell has a new cathode designed by me, but has otherwise the usual structure that Eagleton and I have employed in the past.) He played an important role in connection with this event. He is an undergraduate Electrical Engineering major at about the senior level. We are concerned about the possibility that he may soon return to Indonesia after graduation.

Finally, I note that Cal Poly, Pomona (Shortened form of the California State Polytechnic University at Pomona), has the largest undergraduate engineering enrollment of any university west of the Mississippi. So there is a large number of technically oriented students who can be interested in a project like CF.

IE: ***Your family has been supportive?***

RB: Of course. I note, however, that, even if some unsuspected emanation from CF were to turn one into a "wizened choleric gnome," your family would still love and support you! As you know, I have two sons

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As you know, I have two sons and one daughter, but they are all out of the house leading their own lives now.

Happily, the arrival of my granddaughter Brittany in May of 1989 was also fortunate for my CF research. I was spending so much time in the laboratory that my wife Thelma had become a "research widow." Brittany was living with us early on. (We are supported in this by my son, Bill, her father, and her other grandparents.) My wife loves this beautiful and brilliant little girl as I do, and this is helping her to take cold fusion "widowhood" in stride. In this vein, I am reminded of a joke told at a recent Physics conference—roughly as reported to me by a colleague at Cal Poly, it goes as follows:

> *"A physicist comes home late after working all night and into the early morning hours in his lab, only to be greeted inside his house by the glaring eyes of his wife, who is also presumably holding a rolling pin. Thinking quickly, he says —in a voice indicating at least mild intoxication; 'Hello dear, I've been out carousing with wild women.' Her sarcastic reply is withering: 'No you haven't! You've been to your laboratory again!'"*

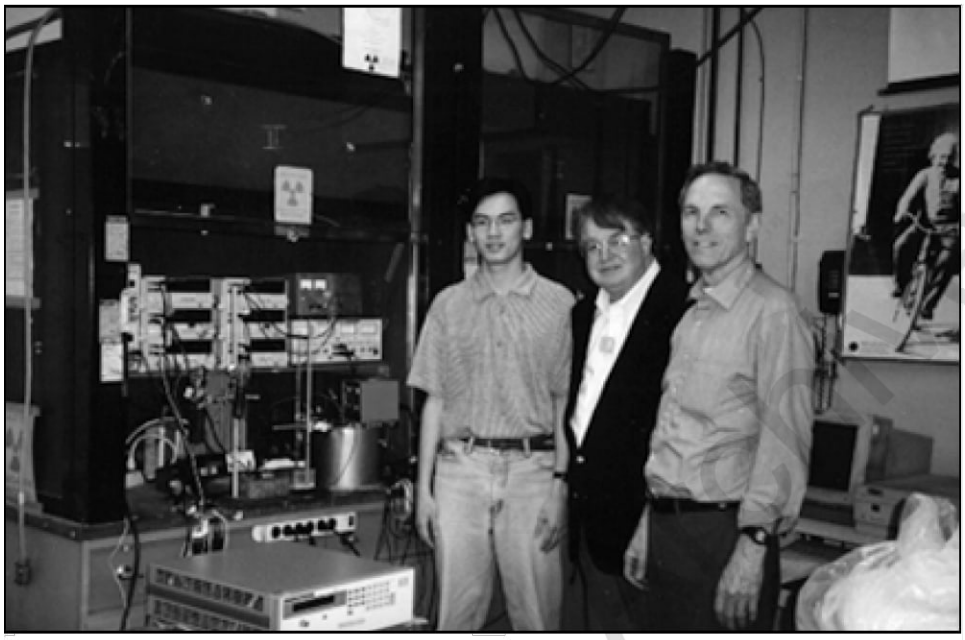
But for Brittany, there go I.

IE: ***Is "cold fusion" a reasonable term for the phenomena we are seeing?***

RB: I believe that it is in the case of the excess heat phenomenon. The transmutation work that I spearheaded at Cal Poly provides, for example, strong evidence for my hypothesis that the addition of a proton to a potassium nucleus yielding a calcium nucleus and a positive Q value [*Ed. Note: Q is the reaction energy.*] accounts for the excess heat observed in the case of electrolysis with potassium salts in those instances where the cathode consists of nickel. This result has been corroborated by Dr. Reiko Notoya of the Electrolysis Institute at the University of Hokkaido, Sapporo, Japan.

As an aside, let me say that it was a considerable thrill to be phoned by your colleague Jed Rothwell from Atlanta, Georgia, with the exciting news that my potassium-to-calcium work had been corroborated "in spades" by a Japanese scientist (Dr. Reiko Notoya) at the University of Hokkaido.

The evidence is even stronger for my hypothesis of the addition of a proton to rubidium nuclei to give strontium nuclei in the case of a rubidium salt-based electrolyte. Certainly such an addition of a proton to a nucleus with the result of increasing the atomic number could reasonably be described as "fusion." And, the fact that the temperature is about three to five orders of magnitude less than those associated with hot fusion would certainly seem to make the additional appellation of "cold" an accurate one.



The Cal Poly, Pomona Cold Fusion Group with Operating CF Cell —Student James Djunaedy, Prof. Robert Bush, Prof. Robert Eagleton *(Courtesy Profs. Bush and Eagleton)*

"Cold fusion" is, to be sure, somewhat of an unpopular term with many of the researchers in CF since the reactions do not "mirror" Tokamak reactions (no pun intended) with respect to the emission of gamma rays and neutrons. CF researchers were appalled to see physicists set this aspect up as a "straw man" to be knocked over as a sort of "proof" that fusion could not be associated with he excess heat phenomenon. "Common sense" employing the ineluctable aspect of a radically different environment from the Tokamak one for the cold fusion reactions was ignored, because it was inconvenient to the "physics-speak" that had, in essence, begun to "demand" that there was nothing there. Once this denial gained momentum, most of the physics rank and file felt that satisfactory "closure" had been achieved and rallied around it.

The physicists were abetted in this by some mistaken nuclear physics of Pons and Fleischmann. Regrettably, then, their excess heat effect "baby" was thrown out with the bad nuclear physics "bath water." The central message of P&F, and one that we were quick to confirm in our own lab despite our strong initial skepticism, that they were getting more out in the form of thermal energy than they were putting in in the form of electrical energy, was all but lost in the din.

Now, Huizenga himself provided me with an interesting fact during his Cal Poly visit, suggesting, in my view, that people like Huizenga should be less harsh on P&F over any initial misinterpretations. According to Huizenga, Enrico Fermi, a hero of mine, was given his Nobel Prize for incorrect nuclear physics. The mistake involved a faulty interpretation of a nuclear experiment involving a phenomenon that had not yet been discovered, namely, nuclear fission. To be sure, Fermi had accomplished so much in nuclear physics that nobody was going to suggest that he give back his award. Still, there was the frustration that fission was involved in a number of Fermi's experiments, yet the discovery of this important phenomenon eluded this greatest of nuclear researchers. Instead, nuclear fission was discovered by the nuclear chemists, Hahn and Strassman. So, these matters of "mistakes" in science are not so simple. Probably as a result of these mistakes, Fermi later said something to the effect that "if at all possible one should avoid being first in a new area of research!" Now P&F were first, and you can see their difficulties. Because of the breakthrough by P&F, researchers like myself have had the advantage of being second, and in essence in gazing on the promised land from the higher vista achieved via that breakthrough. However, the excess heat discovery of P&F will, in my mind, eventually be seen as far overshadowing any mistaken nuclear interpretation that P&F might have made.

With regard to "mistakes" or "errors," I think that it is reasonable to observe that if a "scientist" is not making any mistakes, it almost certainly means that he is not working in an area where the envelope is being pushed or deformed. So much of what we accomplish in science is accomplished by

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trial and error. That sort of safe, or non-threatening, science is really not science at all. It is, rather more akin to technology. "No guts, no glory!" (Or, as perhaps they say in elementary particle physics; "No GUTS, no glory!" (Pun intended.)

Permit me to note, however, that the issue of whether the CF reactions had one-to-one agreement with d-on-d Tokamak reactions was moot practically from the start. Even for a watt of excess power most researchers would have been subjected to lethal fields of gammas and neutrons had the exact resemblance held. This was, of course, referred to early on as the so-called "dead graduate student problem." It now appears that Huizenga's ERAB Panel spent most of its time forgetting this essential fact. Otherwise, logically for Huizenga's ERAB Committee, it had to be a lucky thing they never encountered a live CF cell, since the news of their collective demise would then have constituted probably the shortest, but certainly the most convincing, committee final report in history!

Another positive aspect of the term "cold fusion" is that it is a catchy one and easy for the public to latch onto, in a way that an alternative such as "hydrided metals phenomena" would be unlikely to achieve. Imagine substituting this phrase for "cold fusion" in the recent movie "The Saint," the plot of which involves CF!

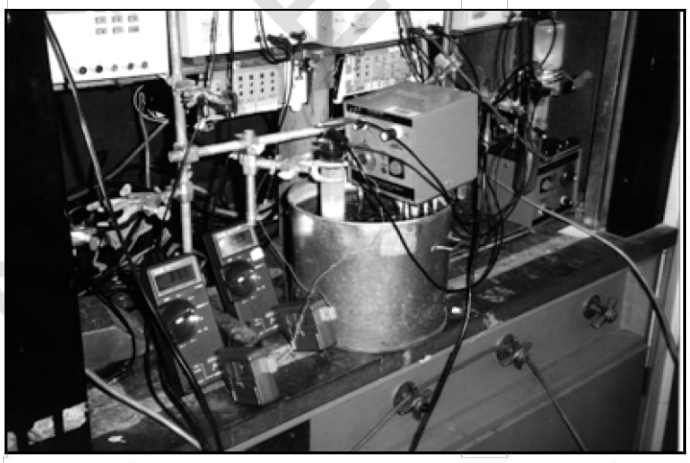
I note, too, that physicist Steve Jones of Brigham Young University, now a major critic of CF, is credited with coining the term "cold fusion." It will indeed be ironic should it develop that this is Jones' principal claim to fame in the History of Science. Along these lines, some physicists will know that physicist J. Stoney invented the term "electron" near the end of the 19th century. But is there anyone around today, other than a historian of physics, who would be able to give any detail of Stoney's scientific work?! In fact, I note that April 24, 1997 is the Centennial Anniversary of the discovery of the electron by J. J. Thompson. I see that Thompson's name is mentioned a lot, but I have not seen Stoney mentioned. In effect "Stoney" has become the answer to a "trivia question" in the history of science.

It is difficult for me to believe that God would tantalize us with this phenomenon without there being a chance of harnessing it in a practical way.

One caveat here: From the work of Miley and Patterson and of Mizuno et al in mass spectrometrically examining light water CF cell cathodes, it is very clear that we are also seeing a phenomenon,which may be termed "cold fission." Heavier elements are being broken down to lighter ones. Looking back at the mass spectrum for the Rb/Sr studies, there is now evidence of stuff potentially produced via cold fission. Frankly, I could kick myself for not thinking of this earlier. (The Fermi story all over again, eh?) The possibility for "cold fission" should naturally be paired in the physicist's mind with that for "cold fusion" on the physical grounds that there is no such thing as a one way mirror for electromagnetic waves.

A revolution is only that if there are defenders of the status quo as well as revolutionaries.

The analogue applicable here is that there should also be no such thing as a one way mirror for de Broglie waves. That is. if de Broglie waves can enter the nucleus they should just as reasonably be able to leave the nucleus. However, in my model, while excess heat arises from the "cold fusion" reactions, the "cold fission" reactions, on the other hand, are at unity gain energy-wise, or even less than one with the extra energy associated with the Q values disappearing via anti-electron neutrinos and electron neutrinos. As you know, neutrinos have a very small cross section for interaction. Nevertheless, it would be interesting to put a cell operating in a cold fission mode near an electron neutrino (anti-neutrino) detector.



One of the Cal Poly, Pomona Cold Fusion Group's Operating CF Cells in Its Calorimeter *(Courtesy Profs. Bush and Eagleton)*

IE: *How about the Patterson Cell? Is that CF in your opinion?*

RB: Although Patterson is concerned not to associate the excess heat effect in his light water cells with the negative baggage of CF, there seems little doubt that the source of the excess heat is CF. Certainly the work of Miley at the University of Illinois, applying mass-spectrometric techniques to examine used Patterson Cell electrodes, demonstrates that nuclear reactions have gone on. The presence of the products of nuclear reactions in used light water cell electrodes that have demonstrated the excess heat effect has also been shown by Mizuno of the University of Hokkaido in a similar manner. Moreover, one of your last issues of *Infinite Energy* [*IE#*10] includes a Letter to the Editor from Eagleton and me commenting on the earlier Cal Poly work, correlating nuclear products with excess heat production, work which I spearheaded. The total energy was calculated by employing the Q values associated with the nuclear reactions to produce the isotopic products found in the post-run cathodic material. Neither the pre-run cathodic material nor electrolyte correlated with the excess heat measured calorimetrically to within plus or minus approximately 5%.

Also, the Patterson Cell is no doubt also "cold fission" as Miley's work suggests.

IE: *Are we seeing "New Physics" in the case of CF?*

RB: "Yes" and "No." "Yes" from the standpoint of Materials Science, and "No" on the basis that both CF and "cold fission" will turn out, much as in the case of the new "tropical superconductors," to simply be the latest surprise of Quantum Mechanics. I note that high temperature superconductivity has still not been explained, despite everybody and his brother attempting to put forward a model combining Quantum Mechanics and the various elements of Solid State Physics.

IE: *Are we seeing a "paradigm shift" with CF and Cold fission?*

RB: In the strictest Kuhnian sense, no. However, when you are getting such incredible surprises from Quantum Mechanics as CF and high temperature superconductivity, it becomes a little difficult to feel that we are simply "mopping up the paradigm"! As you may know, there was a theoretical proof published in *Physical Review* a number of years ago to

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show that 30 K (i.e. approximately minus 243.2°C) is the highest temperature in principle for which one might hope to achieve superconductivity. On the other hand CF has proven to be such an unabsorbable shock that the Physics Community has rejected it essentially wholesale. Only a few "renegade" physicists like myself have given it any hope of being real. Of course, it is very real. Moreover, it is difficult for me to believe that God would tantalize us with this phenomenon without there being a chance of harnessing it in a practical way. At any rate, I guess when the shock is this great to the community of scientists, it makes sense to refer to a "paradigm shift."

As you know, there is a book out entitled *The End of Physics*, [Ed. Note: And another titled, *The End of Science*, with the same message.] which argues that we are never going to see another revolution in Physics such as we have seen with Quantum Mechanics and with Relativity. CF points out the essential meaninglessness of this. Thus, if there are still tricks up the sleeve of Quantum Mechanics, such as CF and high temperature superconductivity, it means that essentially Quantum Mechanics is not complete. The revolution is still going on, and the paradigm is far from complete. Huge surprises delivered within what was considered to be a complete paradigm should at least be considered "paradigm jolts," not shifts. The effect on the collective Physics Community Psyche is going to be just as wrenching, which is a major characteristic, according to Kuhn, of a paradigm shift. Clearly we are in the midst of an ongoing major "explosion" in the field of Materials Science.

IE: ***Your references to Kuhn remind me that you were a graduate student majoring in the History of Science for a year at Berkeley— with Thomas Kuhn of paradigm fame as your professor. Has this helped you to maintain your perspective during the CF "roller coaster" ride?***

RB: "Roller coaster ride" is a good way of describing the unfolding of CF, and we essentially lost the Physicists at the second or third turn! No question about it, my grounding in the history of science, and the history of physics in particular, was always there to fall back on when the landscape seemed particularly bleak. I knew that developments with the birth pangs of CF were episodic in physics, rather than being rare. If you will forgive me momentarily waxing poetic, Tom Kuhn's book, *The Structure of Scientific Revolutions*, blazed meteorically across the intellectual firmament. And, while much of what Kuhn said seems obvious now, it took his genius to first express it. Kuhn's passing last year was a shock. I feel certain that he followed the torturous path of CF while he was alive. I would like to think that, somehow, he is still able to follow this development now.

IE: ***You often refer to CF as following almost a Kuhnian script. Could you briefly elaborate?***

RB: As you may know I wrote a short paper entitled, "Cold Fusion as a Kuhnian Scenario," which was published by Hal Fox in *Fusion Facts*. The intellectual scuffles over CF, the disowning of the subject by Physics, the surprises coming thick and fast...None of these should shock if one is familiar with Kuhn's book. Indeed, Kuhn could have scripted it.

One other thing that I feel is very important along these lines is to not "demonize" the "enemy." Now don't get me wrong, CF has had very real enemies, and some have had horrendously negative effects on the field. However, I am suggesting that those opposed to CF feel that they are operating in good conscience being both "fair" and "objective" vis-a-vis CF, whereas proponents of CF to them are highly "non-objective." On the other hand, CF proponents often feel that the opponents are not operating in good conscience. In a sense, both sides are right, and both are operating in good conscience as they see it. In essence, both are simply playing out their roles in a revolution. A revolution is only that if there are defenders of the status quo as well as revolutionaries.

It is interesting in this sense that there is already a considerable "political spectrum" within the CF community itself. Thus, to many in CF research, I am sure that the light water work appeared, and may still appear, as "heretical" as the heavy water work appears to the general scientific community. Thus, one can refer to the "light water revolution" within CF itself. The success of this revolution, within which I consider myself a prime mover, is rapidly dawning on the CF community as a whole, to the extent that attendees at the Hokkaido Conference (ICCF-6) generally noted that much more attention would have to be given to "isotope effects" at future such conferences.

In this vein it is good to remember that old saying by Julian Huxley: "It is the fate of scientific truths to begin as "heresies" and to end as 'dogma'."

IE: ***Will something have to change in physics education when CF is generally considered successful by the physics community?***

RB: It should, but there is no guarantee. I would like to think that more room will be made in the undergraduate physics curriculum for the history of physics courses, which will include CF as a case study. However, all bets are off, since I am sorry to have to tell you, as if you hadn't already guessed, that we physicists are an arrogant bunch. After all, we are the world's most intelligent people. I take that as a given. Just ask us! The average level of arrogance among physicists could be employed as a practical unit of arrogance for the general population only if preceded by the prefix "micro" (10^{-6}). If, however, the level of arrogance of, say, a Wolfgang Pauli, one of the greatest of the physicists and a prime creator of Quantum Mechanics, were to be used, the prefix would, no doubt, have to be "pico" (10^{-12}). As great as he was, Pauli is now remembered almost as much for his "failures" as for his "successes." Known principally for the Exclusion Principle, he tried to discourage Goudsmit and Uhlenbeck from publishing their work on electron spin, and would have bet his left arm against the possibility that experiments would reveal that parity is not conserved in the weak interactions. Fortunately for Pauli, Goudsmit and Uhlenbeck's electron spin paper turned out to be a smashing success, for Pauli later needed this discovery to establish his famous Exclusion Principle. Madame Wu et al provided an experimental example of parity non-conservation in a weak interaction. Subsequently, the considerably abashed Pauli remarked at how much of a shock it was to discover that, as he put it, "God is a

Cal Poly, Pomona Student James Djunaedy, holding Ni material used in Cathode Fabrication *(Courtesy Profs. Bush and Eagleton)*

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weak left-hander." Moreover, the development of Quantum Mechanics was such a roller coaster ride that at one stage Pauli indicated to a friend that he wished he had become a "circus clown" rather than a physicist.

Too bad that Pauli is not still with us, for he would overwhelmingly qualify for the role of "famous scientist" in Arthur C. Clarke's two Laws— First Law: If a famous scientist says that something is possible in science, he is almost certainly right. Law II: If a famous scientist says that something is impossible, he is almost certainly wrong! (Incidentally I note that Arthur C. Clarke indicated in a recent interview in *Discover* magazine that he firmly believes in the reality of CF (see page 7, this issue of *IE*). One does not need too many conversions of persons at the level of this extraordinary scientist, humanist, and futurologist to achieve the viability of cold fusion in the public eye.

IE: ***You will provided a list that follows this interview of the highlights of your CF research, both experimental research and theoretical. Since you will provide short descriptions of each item we can be reasonably brief here. If you had to pick the top three experimental contributions, what would they be?***

RB: Let me first say that you have been given an "exclusive," in that you are getting original research by me written up at the end of that list. This research deals with the consequences of lattice site occupational symmetry, and I think your readers will enjoy it. It explains, under a simple cover, many of the important empirical observations that have been made in CF by great researchers such as Bockris, Claytor, Pons and Fleischmann, Srinivasan, Takahashi, and others. Your readers are getting it before any research journal, but I note that you published the results of Mizuno's analysis of used cathodes from light water cells before a regular research journal did. So there is a precedent, and I don't think that it is inappropriate.

Picking the top three is not easy for me to do, but let me at least try: (1) The light water electrolytic excess heat work. (2) The electrolytically stimulated transmutation of potassium to calcium. (3) The electrolytically stimulated transmutation of rubidium to cesium.

IE: ***How important is the transmutation research?***

RB: I was apparently the first to hypothesize, and then to successfully test this hypothesis, that the excess heat produced in an electrolytic cell having a nickel cathode, Pt anode, and a light water-based electrolyte containing a potassium salt (e.g. potassium carbonate, potassium hydroxide) was based upon the Q value for a cold nuclear reaction that one might characterize as the electrolytically stimulated transmutation of potassium to calcium. The agreement between the amount of Ca detected in the post-run electrolyte and the amount of Ca expected from the Q value for the nuclear reaction and determined from the calorimetrically measured excess heat was well within the limits of error. The corroboration of my results by Reiko Notoya of the University of Hokkaido did, I feel, put "the frosting on the cake." The importance of this result resides not only in the fact that it was the first demonstration of cold nuclear transmutation associated with the light water excess heat phenomenon, but that its was an independent corroboration.

I tested this (contamination) idea by leaving a vial of nanopure water open to the atmosphere in our hood, and could detect no increase in the calcium level after weeks of exposure.

You must realize that, at that time, the summer and fall of 1991, the light water excess heat effect was considered to be an aberration by many CF researchers. The notion of nuclear reactions where the Coulomb barrier was many many orders of magnitude higher than that for the d-on-d reaction was considered absolutely ludicrous. Today, with findings by Miley of the University of Illinois and, independently, by Mizuno of the University of Hokkaido, my early work in this area is beginning to look very solid, indeed. However, post-Miley, post-Mizuno, it is a little difficult to appreciate the strained atmosphere that existed for even engaging in isotope-excess heat work based upon the light water excess heat effect, much less publishing the results. Thank God for George Miley for having the guts to go with his conscience, and so strongly against the grain of the times, in accepting for publication papers such as mine, "A Light Water Excess Heat Reaction Suggests That 'Cold Fusion' May be ' Alkali-Hydrogen Fusion,'" for *Fusion Technology*, a journal of the American Nuclear Society.

In addition that paper included the first work on the electrolytically stimulated transmutation of rubidium to cesium.

IE: ***The K-Ca transmutation work had come under fire, did it not, because of the possibility of calcium contamination?***

RB: This was about the only comeback left for the critics after Notoya's corroboration of my initial results. After all, went the refrain, you work at Universities where there are clouds of chalk dust...! I tested this idea by leaving a vial of nanopure water open to the atmosphere in our hood, and could detect no increase in the calcium level after weeks of exposure. Remember too, that our cells at that time were operating in a "closed" mode (recombiner employed). Notoya's pre-run electrolysis water has more calcium in it by several orders of magnitude than does our nanopure water, but the increase in calcium concentration after the run would have been easy for an excellent chemist such as Notoya to measure. In addition, the contamination scenario also presumed that, in both cases, the calcium would have to be essentially just enough, and no more, to permit good agreement between the Ca production deduced on the basis of the excess heat detected and the actual Ca experimentally detected. What is the likelihood of this?

Nevertheless, the rubidium-to-strontium results did considerably strengthen my claim for a light water excess heat effect based on cold nuclear reactions. Two separate mass spectrometric analyses were performed: A SIMS analysis that showed that the abundance ratio of the Sr-86 to Sr-88 on the post-run cathode material surface is the same as that of the natural abundance ratio of the Rb-85 to Rb-87, which I had hypothesized to be the respective parent nuclides. The critical notion that this strontium was actually rubidium hydride masquerading as strontium was not very sound from the beginning, since the rubidium oxide signal should have then been larger than the RbH, when in fact it was much smaller This notion was put to rest, however, by an ICPMS mass spectrometric analysis preceded by strengthening the ratio of Sr to Rb present by performing an ion exchange column separation. (The ICPMS analysis and ion exchange column separation were performed by West Coast Analytical Service Inc of Santa Fe Springs, CA. The SIMS analysis was performed under the auspices of a large national laboratory, that apparently still dares not say its name when it comes to cold fusion. I will tell you, however, that scientist George Chambers told me that the putative RbH could clearly not be that because of the ratio of the RbH and RbO signals on the mass spectrogram.) Since then the results of the ICPMS analysis, with the latter preceded by an ion exchange column separation of

the Rb and Sr, when combined with the SIMS analysis, provide a strong argument indeed for my hypothesis of electrolytically stimulated Rb-to-Sr transmutation.

Note that the Sr-86-to-Sr-88 ratio result is immune to natural contamination in the sense that if natural strontium got into the cell somehow, it would simply shift the abundance ratio in the direction of the natural abundance ratio, rather than away from that ratio. Thus, contamination could not yield the amazing result of an abundance ratio of 2.59 for Sr-86 to Sr-88, which is a factor of about 21.6 times the natural abundance ratio of Sr-86 to Sr-88.The fact that this ratio is essentially equal to the natural abundance ratio of Rb-85 to Rb-87 strengthens this part of my CAF Model. The bottom line is that the Rb-to-Sr transmutation result is still one of the best proofs we have for cold nuclear reactions associated with the light water excess heat phenomenon.

In essence then, there has been a "light water revolution" within the CF movement that continues, and is picking up momentum. I concluded my light water paper submitted in July of 1991 by noting: "Finally, it can be concluded that, should this general picture hold up under objective examination, in which the heavy water excess heat reactions and those of light water are viewed as two sides of a coin of a new realm, it would be another step enroute to the creation of an essentially new branch of science, namely, the physics of low-energy nuclear transmutations." Certainly prophetic words, although today I would probably prefer the term "ultra low-energy nuclear transmutation."

IE: ***Could you do the same for your theoretical work? That is, what are your top three contributions in the area of theory?***

RB: Again, as in the case of the earlier question, this is not particularly easy for me. I would liken it to being asked to pick favorites among your children, all of whom you love. At any rate here goes: (1) The CAF Model ("Cold Alkali Fusion") [Generalized to LANT("Lattice Assisted Nuclear Transmutation")]; (2) Statistical mechanical effects based upon lattice filling fraction (stoichiometry); (3) TRM Model ("Transmission Resonance Model") and its successor, the MTRM. ("Modified Transmission Resonance Model").

IE: ***I understand that you have a patent application that has some new theoretical ideas that might advance the understanding of CF?***

RB: Yes. This new theory, which is incorporated as part of a new patent application filed in October of last year, would definitely be one of the three items listed just now, if I could tell you about it here. Unfortunately, at this juncture, it does involve proprietary aspects.

IE: ***Are "proprietary aspects" hindering the development of this science?***

RB: There is no question that "secrecy" tends to hurt the general development and dissemination of science. On the other hand, funding is necessary for equipment, lab supplies, release time from teaching, etc. In an atmosphere where the government is providing no funding, as in the case of CF research, private funding becomes extremely important. Private investors want a return on their money, and patents containing proprietary material are essential. Thus, in the present atmosphere of no government funding, "proprietary aspects" become a "necessary evil" relative to the development of the Science.

IE: ***Finally, one last question. Should you win a significant award in connection with your CF work, as may be possible— given the list of your accomplishments in the the field— who will try to "claim you"?***

RB: I certainly hope that my wife and family will still speak to me! Beyond that I would think that those who would have the biggest stake would be Cal Poly, Pomona, where I am Professor of Physics, and the universities where I acquired my academic training. My undergraduate work in physics was at Michigan State University (East Lansing, MI) I have a Master's Degree in Physics and an A.B.T. degree ("All But Thesis") in Experimental Physics from the University of California at Berkeley, which I attended on a Woodrow Wilson Fellowship. My Ph.D. in Theoretical Physics was from Northwestern University (Evanston, Il)

Finally, Gene, please allow me to say what a thrill and a great honor it will be to appear in the pages of *Infinite Energy* Magazine. The energy and genius displayed by you in your role as Editor-in-Chief, as well as the fantastic work of your associates, have made this magazine an absolute "must read" for those interested in exotic fields of energy research and development, such as CF. Thank you for including me in this *great* magazine.

Highlights of Robert Bush's Cold Fusion Research:

A. Experimental Research: (While these studies were spearheaded by me, they were in collaboration with my colleague Professor Eagleton. My theoretical ideas have generally played a leading role in suggesting experiments to try. Our respective roles within the Cal Poly (Pomona) CF ("cold fusion") Group are more explicitly spelled out in the interview preceding this listing.

1. Thin Film Work: (Refs.1,2) This involved an electrolytic cell (LiOD based electrolyte) study of the excess heat effect in a thin film of Pd (five microns thick) electroplated upon silver substrate. (The electroplating was provided by E. Storms of LANL (Los Alamos National Laboratory), who was formerly a scientific advisor to ENECO.) In ref. 1 I reported that we had " "obtained about 15 MJ of excess heat over about a 54-day period with a peak excess power of about 6W and an average excess power of about 3.2 W, with the latter being approximately 28% of the input power." I employed[1] "this data to estimate a lower limit for the normalized excess heat produced in the thin film of about 63GJ per mole of palladium." I noted[1] "that this result is at least a factor of a million too large for it to have been of chemical origin."

Prior to this, critics of CF claimed that, even if the excess heat effect turned out to be real, one would need the world's known reserves of Pd to construct a reactor. This study showed CF occurring as a surface, or near-surface, phenomenon, or both. Thus, a megawatt reactor would have a

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large surface area, but require no more Pd than one could fit onto one's thumbnail.

2. Light Water Excess Heat Studies: (Refs. 1, 5, 6, 7): Excess heat was obtained with electrolytic cells employing Ni cathodes and a light water based electrolyte containing an alkali atom salt (Typically hydroxide or carbonate.). Excess heat was observed for salts of the alkali atoms K, Li, Na, Rb, and Cs.) A remarkable feature was that Dr. Randell Mills had claimed that no excess heat should be obtainable with Na. My CAF Model ("Cold Alkali Fusion") predicted that Na should work, and I showed[1] that it gave excellent results. Critics have claimed that this discrepancy between my Na results and the null result of Mills points to the light water excess heat effect as spurious. However, in a theoretical model incorporated in a recent patent application, I have provided an explanation for this discrepancy between my results and Mills' results. (Our most favorable light water results employed light water cells with "nickel fibrex," a fibrous nickel material invented by J. Steppro of National Standard Corp., Mishiwaka, Indiana, and kindly provided by him for our research. Much of this work was sponsored by ENECO.)

M. Srinivasan (Head of the Nuclear Physics Division, Bhabha Atomic Research Center, Trombay, Bombay, India) and Jed Rothwell (Contributing Editor, *Infinite Energy*) introduced my light water work to the Mizuno-Enyo group of the University of Hokkaido. Thus, the Cal Poly, Pomona, light water work was influential in stimulating Srinivasan's own light water work in India, and indirectly responsible, via Srinivasan and Rothwell, for stimulating the Japanese light water work at the University of Hokkaido.

3. Nuclear Transmutation of K to Ca: (Refs. 1,5) in a light water-based electrolytic cell with a potassium salt electrolyte. This result is vastly strengthened by the corroboration by the outstanding electrochemist, Dr. Reiko Notoya, Hokkaido University, Japan.

4. Nuclear Transmutation of Rb to Sr: (Refs. 1,5,9) in a light water-based electrolytic cell with a rubidium salt electrolyte. Because of its essential immunity to contamination on the high value side, this change of the natural abundance ratio of Sr-86 to Sr-88, by a factor of about 21.6 times the natural abundance ratio of these two isotopes, should be considered one of the strongest pieces of evidence that we presently possess for the light water excess heat effect and its connection with electrolytically stimulated transmutation.**

5. Discovery of a Cold Nucleosynthetic Series: (Ref: 9) This was also the basis for our *Letter to the Editor* in Issue #10 of *Infinite Energy* Magazine. The letter pointed out that this research on multiple isotope production in a light water cold fusion electrolytic cell was performed about three and one half years before the recent work of Miley, and of Mizuno et al in this research area. A special feature of my work, and one that was not included in the more recent work was the demonstration of a significant correlation between the total excess heat determined via calorimetry and that based upon the amount of each nuclide produced as gauged from post-run and pre-run SIMS mass spectrographs and the respective Q values of the nuclear reactions.

6. Correlation between X-Ray Flux and Excess Power: (Ref: 6) A silicon crystal detector connected to a multichannel analyzer had to be positioned essentially at the surface of the cell to achieve this study in real time, which showed a very strong correlation between the x-ray flux associated mostly with bremmstrahlung, as determined by summing the results from a large number of the lower energy channels, and the excess power. This provides additional evidence for my hypothesis[1,10] that electrons are associated with the partial lowering of the Coulomb barrier, which allows increased Quantum Mechanical tunneling.

7. Anti-Correlation of Neutron Flux and Excess Power: (Ref: Poster at the Como Conference, ICCF-2.) Here again, it was necessary to position the neutron detecting tube very close to the electrolytic cell.

8.Stimulation of Excess Heat via Impurities such as Cu: (Ref.12)

9. Observation of Characteristic X-ray Lines: (Ref.14).

10. Radioactive Decay of a Cathode: (Ref: 9)

11. Observation of High Gain Associated With Small Currents in Light Water -Based Electrolytic Cells: (Ref.14)

12. Observation of Excess Power vs Current, and vs Temperature to Corroborate the TRM Model: (Ref: 4)

B. Theoretical Research:

1. TRM ("Transmission Resonance Model"): (Refs.: 3,4)

2. Modified TRM; Connection With the Mössbauer Effect: (Ref.1) This showed that the TRM might also be given an alternative

3. Hypothesis of Transmutative Production of Ca from K for the Light Water Excess Heat Effect: (Ref.1)

4. Hypothesis of Transmutative Production of Cs from Rb: Importance as a Significant Signature of CF: (Ref.1)

5. CAF Model: (Ref.1) The term "Cold Alkali-Hydrogen Fusion (CAHF) was shortened to "Cold Alkali Fusion" based upon a suggestion to the author by J. Drexler, CEO of Drexler Industries, Los Altos Hills, CA. Drexler noted to the author that there is a form of fusion called "Alkali Fusion."

6. LANT Model: (Ref.9) This is a generalization of the CAF Model with the acronym standing for "Lattice Assisted Nuclear Transmutation." In that regard I note the crucial nature of the lattice. A point of interest here is that, under circumstances of high temperature but extremely high pressure, it might be possible for a latticial structure to exist, even in the face of the high temperature. In such a case the LANT phenomenon could exist, but this fusion would hardly be described as "cold." Thus, "cold" means only cold enough to permit the existence of a "lattice." One crazy idea: Could not some "lattice" structure exist in the core of the Sun where the temperature is extremely high, but the density is about one-hundred times the density of iron? If so, the so-called standard model for the Sun would be in need of revision. This might explain the "anomalous results" that R. Davis is seeing with his neutrino detector in a South Dakota lead mine. This "anomaly" is presently hypothesized to be the result of the so-called "neutrino oscillation."

7. ECFM ("Electron Catalyzed Fusion Model"): (Ref. 8) This model was employed to derive a one-parameter model expression for excess power and, separately, for the rate of tritium production, with each formula containing an appropriately derived statistical mechanical factor based upon the loading fraction, S. The excess power expression gives an excellent fit to the McKubre et al curve of excess power vs. loading fraction (S) for a Pd-heavy water system, and also to the independent curve of excess power achieved experimentally for such a system by Kunimatsu et al.

8. Statistical Mechanical—Stoichiometric Results:* (Ref. 8, 10) This item, along with items 9. through 14. (i.e., the asterisk-marked items), are treated in Ref.10. by the author in this issue of *Infinite Energy Magazine* in a research exclusive for its readership entitled "Consequences of Lattice Occupational Symmetry"

9. Relation Between Tritium and Excess

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Heat Production*: (Ref.8,10)

10. Anti-Correlation Between Neutron Emission and Excess Heat Production*: (Ref. 8,10)

11. Autoradiography Enhancement by a Surface Effect*:(Ref. 10)

12. Augmenting Excess Heat (Tritium) Production by Annealing (by leaving Unannealed)*:(Ref. 10)

13.Hypothesis for "Capillary Fusion"*: (Ref.10)

14.Triggering of Tritium Production, Neutron production, and Excess Heat*: (Ref.8,10)

15. Cold Fission and Cold Fusion Reactions to Explain the Results of Mizuno et al. and Miley and Patterson: (Ref.15)

16. Branching Ratio for Neutron/Triton Production: (Ref. 8,10,11)

$$BR = (r/R)^{1/2}\{[1- (r/R)^3]^3 + 4(r/R)^3[1- (r/R)^3 + 6(r/R)^6(r/R)^3 [1- (r/R)^3] + 4(r/R)^9\}^{-1}$$

Now, since the ratio r/R, where r is the protonic charge radius and R is the deuteronic charge radius, is so small, this rather formidable looking result result boils down to the following excellent theoretical approximation:

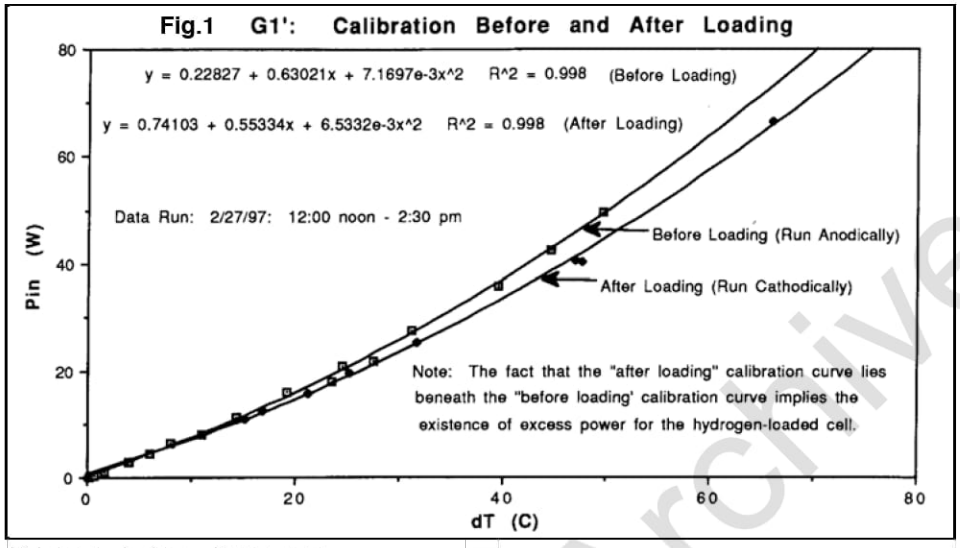
$$BR = (r/R)^{1/2}$$

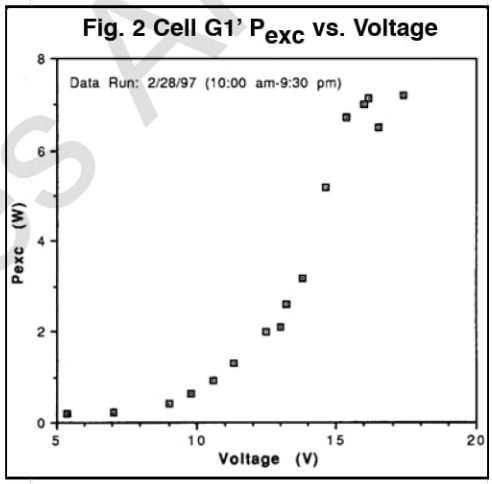
When the experimental values values of r and R are substituted this becomes BR = 10^{-9}, which, so far seems to match the empirically observed value given by Claytor.

17. "X": Filed as part of a new patent application, with aspects that are still proprietary.

References:

1. R. Bush, "A Light Water Excess Heat Reaction Shows that 'Cold Fusion' May be 'Alkali-Hydrogen Fusion'," *Fusion Tech-nol.*, 22, Sep. 1992, 301.
2. R. Bush and R. Eagleton, "A Calorimetric Study of the Excess Heat Effect in Thin Films of Palladium," delivered by Bush at the Second Annual Conference on Cold Fusion, June 29, July 4, 1991, Como, Italy.
3. R. Bush, "A Transmission Resonance Model for Cold Fusion," Winter Meeting, American Society of Mechanical Engineers, San Francisco, California, Dec. 12, 1989.
4. R. Bush, "Cold Fusion: The Transmission Resonance Model Fits Data on Excess Heat, Predicts Optimal Trigger Points, and Suggests Nuclear Reaction Scenarios," *Fusion Technol.*, 19, 313.
5. R. Bush and R. Eagleton, "The Transmission Resonance Model for Cold Fusion in Light Water: I. Correlation of Isotopic and Elemental Evidence with Excess Power," Proc. ICCF-3, 409 (1993).
6. R. Bush and R. Eagleton, "Experimental Studies Supporting the Transmission Resonance Model for Cold Fusion in Light Water: II. Correlation of X-Ray Emission with Excess Power," Proc. ICCF-3, 409 (1993).
7. R. Bush and R. Eagleton, "Calorimetric Studies for Several Light Water Electrolytic Cells with Potassium Carbonate and Sodium Carbonate Electrolytes and Nickel Cathodes," Proc. ICCF-4, 1994
8. R Bush, "A Unifying Model for Cold Fusion," *Transactions of Fusion Technol.*, 26, No. 4T, Dec. 1994, 431.
9. R. Bush and R. Eagleton, "'Evidence for Electrolytically Induced Transmutation and Radioactivity Correlated with Excess Heat in Electrolytic Cells with Light Water Rubidium Salt Electrolytes," *Transactions of Fusion Technol.*, 2G, No. 4T, Dec. 1-4, 344.
10. R. Bush,"Consequences of Lattice Occupational Symmetry," *Infinite Energy* Magazlne, this issue (#12).
11. R. Bush, "An Approximate Theoretical Branching Ratio for the D-on-D TRINT Reaction," *Fusion Facts*, 31, Sept. 1990.
12. R. Bush, "A Model for the Impurity Promotion and Inhibition of the Excess Heat Effects of Cold Fusion," *Proceedings of ICCF-5*, 1995, 343.
13. R. Bush, "Electrolytically Stimulated Cold Nuclear Synthesis of Strontium from Rubidium," talk presented at the First Texas A&M Conference on Low Energy Nuclear Reactions, Summer, 1994.
14. R. Bush, "Can the ECFM ("Electron Catalyzed Fusion Model") Account for Light water Cold Fusion?", talk presented at the First Texas A&M Conference on Low Energy Nuclear Reactions, Summer, 1994.
15. R. Bush, "Some Theoretical Observations Upon Lattice-Assisted Nuclear Reactions in an Electrolytic Cell with Pd (Cathode) and Pt Anode)," talk presented at the Second Texas A&M Conference on Low Energy Nuclear Reactions, Summer, 1996.





The Blinking Cell

The cell **G1'** "that made Huizinga blink" employs our standard electrolytic cell design with the anode consisting of an axial platinum wire (1 mm in diameter) wrapped in a spiral about a thin teflon-coated glass rod of diameter 3mm. The cathode follows a proprietary design, but we can say that it primarily involves Ni fibrex. (Ni fibrex is a material invented by Jim Steppro of National Standard, Inc., Mishiwaka, Indiana). The Ni fibrex is in the form of a thin annulus of radius 2 cm with about a 6mm spacing between the annulus and the wire anode .]

Calibration in the water bath, which was maintained at 30.2°C, was carried out on 2/25/97 by running the cell anodically (backwards, with the anode turned into a cathode and vice versa) Fig.1 shows two Cricket graph curves, with the top curve being a copy of the calibration curve that Huizinga was shown. Note that it provides a good fit over the full range of calibration up to 50 net watts in. The cell is calibrated and run with about three-fourths of the cell submerged in a water bath with about 6 liters of water maintained at 30.2°C and kept well-stirred. The ***net*** power in is taken to be $P_{applied}$ (IxV) + $P_{dissociation}$ [(-1.48V)xI]. *Note well: separate tests show that recombination inside this open cell is essentially negligible.*

Hydrogen loading was carried out cathodically on (2/25/97) at low current density. The data for the curve underneath the calibration curve in Fig.1 was taken 2/27/97 and this curve portrays a new "calibration curve" after hydrogen loading. That this new curve lies below the original calibration curve provides good evidence that we are seeing excess power.

Fig.2 is a Cricket graph that is a copy of the excess power graph that Huizinga was shown upon his visit to our lab. The data was taken during the morning of the day of the visit, 2/28/97. The top data points show an excess power of about 7W (About 50 Watts in and 57 Watts out, for about a 114% gain.) This cell G1' is still functioning.

New Energy Times Archive

Consequences of Lattice Occupational Symmetry

by Robert T. Bush (Physics Department, Cal Poly, Pomona)

All of the items in my listing of theoretical research accomplishments (viz. 8-14) are a consequence of the Statistical Mechanical considerations associated with the occupational symmetry of the hydrogen-absorbing metal lattice (or interstitial lattice). In my paper of reference (8) a statistical mechanical treatment is employed to take into account the statistical aspects of lattice filling associated with nearest neighbor interactions, leading to one of the factors in an expression for theoretical excess power in CF.

In this treatment I recognized a "Tokamak regime" for the nuclear d-on-d reaction and its extreme opposite, the "anti-Tokamak regime." The Tokamak regime is associated with the "normal" situation occurring in a magnetic bottle with a deuterium plasma. The vast bulk of the d-on-d reactions result in either a triton plus a proton being produced, or in a He^3 nucleus plus a neutron. These two reactions have essentially an equal probability for occurrence (i.e equal cross-sections). The third possibility, namely that of d-on-d, giving a He^4 nucleus (alpha particle) plus a gamma ray, has a probability of only about one ten thousandth that of the other two reactions.

However, in the hydrogen absorbing metal (e.g. palladium, environment for the "anti--Tokamak" regime) it is hypothesized that the chances of this latter reaction occurring are boosted by enough orders of magnitude that the probabilities are essentially reversed. A one-dimensional model is considered in which it is the symmetry of occupation of the lattice that determines what the relative probabilities will be for the three reaction product scenarios (He^4 + phonons), (t,p), and (He^3,n) Thus, two nearest-neighbor d's situated in the one-dimensional lattice, such that each has an additional nearest neighbor, possesses a symmetry such that the charge polarization effect on the protonic charge distributions of each of the two reacting d's in the d-on-d reaction is orthogonal with respect to the axis along which they react, as opposed to lying along that axis. This symmetrical situation highly favors the production of a He^4 nucleus as the reaction product (plus phonons).

On the other hand, in sharp contrast to this is the reaction between two nearest neighbor d's in a situation where this symmetry is "broken," so that one or both of the additional nearest-neighbor d's is missing. This "broken symmetry" in the occupation of the lattice favors a reaction in which charge polarization leaves the two protonic charge centers of the interacting d's as far part as they can get, i.e. shifted towards the trailing edges of the approaching d's. This collision tends to favor the Oppenheimer-Phillips type d-on-d reaction, leading to the production of a triton (t) and a proton (p). The d-on-d leading to a neutron plus an He^3 nucleus is more favored here than in the symmetrical situation, but the probability is much much lower (approximately by a factor of 10^{-9}) than that for production of (t, p), as shown by my derivation of the branching ratio (BR) shown in item (16) previously in the theoretical achievement list.

The collisions between the d's in a Tokamak would tend to be more "glancing"—as opposed to "guided," as in the symmetrical lattice situation. (For the latter, think of beads strung upon a wire.) Thus, the (t,p) and (n,He^3) would result with essentially equal probability for the Tokamak regime. On the other hand, a "head on" d-on-d reaction to produce He^4 (plus a gamma) would be relatively rare for the Tokamak regime, since, again, "glancing collisions" are highly favored over "head on" ones.

We now look at the implications of the model:

(1.) The ratio of "symmetry favored" d-on-d reactions in the lattice resulting in He^4 production to "broken symmetry favored" reactions favoring tritium production, and to a much lesser extent He^3 and neutron (n) production by way of the branching ratio, is a function statistically of the fractional filling of the interstitial lattice, i.e. a function of the "stoichiometry," S. [For our purposes I will assume that S varies from zero (no d's in the lattice) to 1.0 (all sites filled with d's).] Clearly, the larger S the more favorable is the situation for producing He^4. Excess heat production associated with He^4 production typically first begins to be detectable in the range of S=0.82 to S=0.85. On the other hand my model shows that tritium production should peak at about S=0.7 and plunge rapidly with increasing S.

(2.) Thus, the experimental curve of Bockris, showing the excess heat production to be about a thousand times greater than would be expected based upon the observed tritium production, is for an approximate S value of 0.8.

(3.) This would also explain the anti-correlation reported between neutron flux and excess power by Takahashi, the Cal Poly Group, and others. When S is large enough to allow an excess power, the filling condition (S value) for neutron production has fallen off significantly. The higher the excess power, the lower the neutron flux from the cell, and vice-versa.

(4.) Any process that increases S in the filling regime above approximately S=0.8 can help to trigger observable excess heat, whereas any process that decreases S towards a value of about S=0.7 can help to trigger observable tritium production. Thus, if a voltage surge knocks d's out of a fraction of the sites in this latter case, this could increase tritium production. However, an increased field associated with a larger current and ion flux could increase the value of S and thus trigger observable excess heat.

(5) Boundaries, such as surfaces and grain boundaries automatically "break the occupational symmetry" since a d occupying the lattice site nearest the boundary can have only one nearest neighbor (one-dimensional lattice model).

Let us explore the implications:

(i) To encourage excess heat production, metal crystals should be made as large as possible, since this minimizes the number of grain boundaries and surfaces. The inverse of this is that samples with lots of relatively small crystallites, such as might be produced by sintering, will maximize the production of tritium and neutrons.

(ii) As an example of (i), annealing, which tends to produce larger crystals and minimize the number of grain boundaries , favors excess heat production, and relatively disfavors tritium production and neutron emission, relatively speaking. On the other hand, to study tritium production or neutron emission, one should leave the samples unannealed. Claytor at LANL has apparently observed this effect of unannealed samples favoring tritium production relative to annealed samples.

(iii) Any development of a geometry in the metal sample which favors an increase in surface area (e.g. needlelike growths) could trigger increased tritium and neutron production via the increase in surface area sites. A well-known case here is that of the "dendrites" reported by Bockris and correlated with his observation of tritium production. Thus he observed no detectable tritium until the dendritic growths had reached a certain size. Such dendritic samples should also be ideal for studying neutron emission.

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(iv) Another example of (iii) occurs in the case of the correlation between observing excess heat with a Pd sample and the deposition of Pt black onto the Pd cathode from the Pt anode. This has been observed in our own lab. Thus, not only is more surface area created (which favors tritium and neutrons), but also additional volume near the surface source of d's which can also help one to observe excess heat. This would tie in with Bockris's example also of observing a ratio of excess heat production to tritium production. Thus, as the dendrites grow thicker, the ratio of volume to surface would increase so that excess heat production (He^4 production) might not increase more rapidly than tritium production is increasing.

(v) Surfaces of samples should maximize tritium production allowing relatively good autoradiographs. Moreover, the growth of tritium at such surface sites favoring tritium production should essentially be in "circular spots." For example, heat produced at the center should produce an expanding spherical boundary ("broken symmetry" of occupation in a spherical pattern) around which additional tritium production would be favored. At the surface this would take the form of a circular spot. At several International CF Conferences, Srinivasan of the Bhabha Atomic Research Centre (Trombay, Bombay, India) has shown just such spectacular autoradiographs with well-demarcated circular "hot spots."

(6) "Capillary fusion": This fusion, predating CF, is still a mystery, but has ample data suggesting that it is a real phenomenon and is fusion. Now, the capillary geometry tends to maximize the surface area for a fixed volume. (Note that, ignoring the end areas, which is a reasonable approximation, the surface area of a cylindrical capillary of fixed volume is multiplied by a factor of n if its radius is divided by a factor of n.) Thus, any "pinching" process that tends to increase the area could also provide more "broken symmetry" surface sites for the production of tritium and neutron bursts. Note that neutron bursts are simply a consequence of Poisson statistics, since neutron production is down by 10^{-9} from tritium production as a consequence of the branching ratio, which is, in turn, a consequence of the protonic charge polarization produced in a d-on-d collision in the lattice (one-dimensional lattice model). Whether or not capillary fusion has the same cause as CF, they nevertheless seem to share this aspect of occupational symmetry affecting reaction product

(7) Finally, something really wild!: The "Z-Pinch" in a deuterium plasma: Such pinches in the deuterium plasma are associated with neutron bursts. Perhaps this has the same cause as the neutron bursts in "capillary fusion." While a plasma may not seem like a "crystal" with lattice sites, it is important to recall that water, a fluid as is the deuteron plasma, is often considered to be a "variable crystal." The same could probably be said for the deuterium plasma, in which case, depending on the time scale, which seems right, the neutron bursts could simply be partially the consequence of the fact that the "pinch" considerably enhances the surface area.

Finally, it is interesting to note that such a simple phenomenon as the symmetry, or nonsymmetry ("broken symmetry") might be the common thread tying together so many of the important empirical observations of CF and, even beyond. While it does not solve the ultimate mystery of CF, which I have opined to be enhanced tunneling by virtue of a Coulomb barrier being vastly reduced by electronic charge, it does provide a mechanism of such simplicity to account for so much, that it becomes difficult to doubt the reality of CF itself. For CF this is progress.

Acknowledgement: *I wish to express my appreciation to editor Gene Mallove. I believe that the stimulus of preparing other material for this issue of* Infinite Energy *prompted a creative burst, which resulted in putting together a number of ideas that formed this article.*

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Mills and BlackLight, from page 21

heavy water-based cold fusion cells. Could it be that the shrunken hydrogen atoms are promoting various kinds of nuclear reactions, especially *fusion* and *fission* within heavy elements? Furthermore, can we rule out the possibility that BOTH the Mills process and various lattice-induced nuclear processes are occurring. One does not necessarily exclude the other. Mills, however, has not shown much enthusiasm for the cold fusion field. He does not attend its international conferences and tries to distance himself from the field by calling it a "failed" attempt to extract nuclear energy from water. His associate and mentor, Prof. John Farrell of Franklin Marshall College in Lancaster, PA fully supports the Mills theory, but appears to be more open-minded about examining the transmutation data.

This Editor has enormous respect for Dr. Mills and his work. Contrary to many of my cold fusion colleagues, I believe the evidence for the hydrinos is impressive, growing, and *demands* the most serious attention. I cannot abide the comments of those in cold fusion who disparage this data based on established QM theory. It could well be that QM is in need of this kind of major revision. If hydrinos are confirmed—and there is *no better way than via demonstration devices* that Mills says he is now investigating—that would be proof that QM is in big trouble. These devices Mills is working on would show directly the deep ultraviolet radiations that would come from the atomic hydrogen transitions to lower energy levels.

Mills' theory is put forth as a major selling point by BLP. The 576-page hardbound book, *The Grand Unified Theory of Classical Quantum Mechanics*, (updated through 3/25/97) is available for $50.00 plus postage and handling from BlackLight Power, Inc., Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 1935541 —Fax: 610-651-4940.

The BLP WWW site has some nice commentary on the Mills theory. In part, from Shelby Brewer: "First, the Mills Theory tidies up theoretical physics by stitching together quantum mechanics and relativity. That in itself is a major triumph. Second, and more important, the Mills Theory explains several major empiracle anomalies that have vexed physicists for decades: the sun's energy balance deficit; the dark matter in space phenomena; and mountains of atomic spectral data that is inconsistent with prevailing theory. Third, the Mills Theory gives rise to the possibility of an inexhaustible energy source based on phenomenology not yet recognized and

Continued on page 41

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ICCF-7 News
Vancouver, Canada April 19-24, 1998

Letter received from the ICCF-7 organizing committee:

February 7, 1997

Greetings,

Welcome to beautiful Vancouver, Canada's gateway city to the Pacific and the conference site for the 7th International Conference on Cold Fusion (ICCF-7).

I would like to invite you, your colleagues, and your spouse or partner to attend the conference on April 19-24, 1998. ICCF-7 will take place in Vancouver's waterfront Convention & Trade Centre which is pictured in the foreground on the cover of the enclosed brochure. Vancouver is a safe, clean city where the snowcapped Canadian Rocky Mountains meet the clear blue Pacific Ocean.

The exciting field of low energy induced nuclear reactions in solids has continued to mature, and many new, compelling scientific findings are becoming known. The ICCF conference series provides a unique forum for direct interaction with top scientists from around the world. The diversity and quality of on-going research and its commercial implications make ICCF-7 an important event that should not be missed.

Enclosed is a three page ICCF-7 Preview, a Vancouver information brochure, and a questionnaire form. Please return your completed questionnaire by March 1st, 1997. Wherever possible, we will incorporate your input into the Vancouver program. The ICCF conferences are organized solely to benefit you, the participant, so be sure to give us feedback on your preferences.

With your input and support, ICCF-7 will truly be *"The Best Ever!"*

Sincerely, Fred Jaeger
Organizing Host for ICCF-7

c/o ENECO, 391-B Chipeta Way, Salt Lake City, UT 84108; PH:(801) 583-2000; Fax: (801) 583-6245; jaeger@ENECO-USA.com

Excerpts from the ICCF-7 mailing:

SCIENTIFIC PROGRAM

Selection rules and evaluation criteria for papers will be sent to all potential presenters beginning with the June '97 call for abstracts. The final announcement of oral and poster categories will be sent by December 15, 1997.

The LOC (Local Organizing Committee) will adopt a standard set of published guidelines for objective evaluation of all papers. A different topic is planned for each day at ICCF-7. It is proposed that an invited presentation with summary review or global implications for the entire field begin each day's topic. Following the opening session, five 20-minute oral presentations are proposed that meet specific criteria for the best individual work based on rigor, quality, uniqueness, innovation, and clarity of English language presentation. Afternoons will be entirely devoted to enhanced poster sessions, which include a 3-5 minute oral preview and summary.

Something new? ... Have all ICCF-7 participants drop a name in a box at Wednesday eve's banquet to vote for the ten posters with the highest interest. Each of the "Top Ten" poster presenters selected will conduct a 15 minute expanded oral presentation to the full audience Thursday afternoon.

Something different? ... Official concluding ceremonies will take place at a Friday morning brunch. Events could include a mix of formally prepared scientific conclusions and an informal discussion session. The informal session would permit and encourage a wide cross-section of audience members to voluntarily present their own 3-5 minute impromptu talk about "What ICCF-7 meant to me"; or "What was the most interesting presentation to me and why"; or "Where I think we should go from here and why"; etc.

Something late? ... Evening educational workshops that present recommended experimental techniques to properly measure heat, helium, and low-level nuclear events are proposed.

Program Summary: 4 Invited Presentations, 20 Oral Presentations, 10 extended oral presentations of posters, 150-180 poster presentations, three evening workshops, and a half-day closing ceremony.

Other information:

The ICCF-7 venue is a government owned Trade & Convention Center on the waterfront in the heart of downtown. Ballrooms have been rented that hold between 225-450 persons in classroom seating, with expansion capability to 1,100 persons. An estimated $450 USD per person conference fee would include the Sunday eve reception, all sessions and publications, Wednesday eve entertainment & banquet, four lunches, mid-morning and afternoon refreshments, and Friday morning brunch. Some 415 hotel rooms in five Vancouver hotels have been blocked at special conference rates: Pan Pacific, Waterfront, Hyatt, Renaissance, and Day's Inn.

With maturation of the field, ICCF-7 seeks to attract a more diverse audience: additional scientists, research institutes, students, national funding agencies, commercial interests, journalists, and spouses.

ICCF-7 VANCOUVER "The Best Ever!"

CALENDAR

1st Low-Energy Transmutation Meeting
At Texas A&M University
June 19, 1995

The 2nd World Hydrogen Summit
September 28
-October 1, 1995
Montreal, Quebec, Canada

16th Symposium on Fusion Engineering (SOFE '95), *with cold fusion component!*
October 1-5, 1995
Champaign, Illinois

Third Russian Conference on Cold Fusion and Nuclear Transmutation
October 1—8, 1995
Sochi, Russia

Power-Gen '95
(CETI cell demo)
Anaheim, California
December 5-7, 1995

New Ideas in Natural Sciences
June 17-22
St. Petersburg, Russia

1996 International World Energy System Conference
June 19-21, 1996
Toronto, Canada

2nd Low-Energy Transmutation Meeting
College Station, Texas
Sept.13-14, 1996

ICCF6—Sixth International Conference on Cold Fusion
October 13-18, 1996
Hokkaido, Japan

Building Energy—Insuring a Sustainable Future
March 12-15, 1996
(Sponsor: Northeast Sustainable Energy Association)
Radisson Hotel and Conf. Center
Cromwell, Connecticut

INTERNATIONAL SYMPOSIUM ON NEW ENERGY
(Sponsor: Academy for New Energy)
May 23-26, 1997
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ICCF7—Seventh International Conference on Cold Fusion
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The author, Frank Znidarsic, has a B.S. in Electrical Engineering from the University of Pittsburgh, has an Associate in Science from Saint Francis College, and is a registered professional engineer in the state of Pennsylvania.

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TAPE#1

Dr. Eugene F. Mallove
(Cold Fusion Technology, Concord, NH)
"Cold Fusion and New Energy Technology - An Overview"

Dr. Peter Graneau
(Northeastern University Center for Electromagnetic Research) "Anomalous Forces in Water Plasma Explosions"

TAPE#2

Buford ("Ray") Conley
(MIT, graduate student, Dept. of Aero/Astro Eng.)
"Light Water Excess Heat Experiments"

Fred Jaeger
(ENECO, Salt Lake City)
"Patents and Commercialization"

Professor Peter L. Hagelstein
(MIT Dept. of Electrical Engineering and Computer Science) "Cold Fusion: What We Know and What We Don't Know"

TAPE#3

Professor Peter Hagelstein
(CONTINUED from TAPE #2)
"Cold Fusion: What We Know and What We Don't Know"

Professor Keith Johnson
(MIT Dept. of Materials Science and Engineering)
"Progress in the Theory of Excess Heat" *and Excess Heat*- The Movie, now being made by Hollywood!

James L. Griggs
(Hydro Dynamics, Inc., Rome, Georgia, USA)
"The Hydrosonic Pump: Excess Power and Other Effects"

TAPE#4

Bertil Werjefelt
(PolyTech(USA), Hawaii)
"Energy from Magnetic Materials and Magnetic Fields"

Dr. Eugene F. Mallove
(Cold Fusion Technology, Concord, NH)
Concluding Remarks

The tapes include the speakers' presentations as well as question and answer sessions. There is footage of the Hydrosonic Pump under test as well as close-up footage of rotor surface melting effects. Bertil Werjefelt shows footage of experiments in his own laboratory. There are scenes of Japanese researchers from Sumitomo, Hitachi, and other companies and universities now involved in their claimed extraction of energy from magnetic materials. These efforts are now said by these researchers to be proceeding toward commercialization. Actual experiments are seen in progress. The tapes are VHS cassettes in NTSC format and range from 120 to 127 minutes each.

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4-AA	TOM VALONE	FREE ENERGY & PROPULSION
5-AA	JAMES GRIGGS	THE HYDROSONIC PUMP
6-AA	EUGENE MALLOVE	COLD FUSION & NEW ENERGY
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American Nuclear Society Annual Meeting in June to Feature Cold Fusion Speakers and *Possible* (Probable?) Demonstration Units

Yet another ANS (American Nuclear Society) meeting will feature a cold fusion component. This time, there will be presentations by speakers, in addition to a booth exhibit by Clean Energy Technologies, Inc. (CETI)—as at the meeting in Washington, DC last Novemeber, when CETI announced its RIFEX™ transmutation kits.

Here are the particulars of the meeting, provided to us by Prof. George Miley of the Dept. of Nuclear Engineering, University of Illinois (Registration information may be found at www.ans.org):

American Nuclear Society Annual Meeting
Orlando, Florida, June 1-5, 1997
Room Grand XIV, Session 8.6

"Low Energy Nuclear Reactions" Panel Session
Sponsor: Isotopes and Radiation Division

The panel members will provide 20 minute presentations of their views and research related to Low Energy Nuclear Reactions (LENR), after which an open interchange of questions and comments will be held with the audience. LENR includes possible nuclear reactions in solids loaded with reacting materials such as hydrogen and deuterium (cf. Cold fusion energy production, transmutation reactions, and other unique anomalous effects), as well as effects related to collapse of supercritical bubbles in the liquid phase in contact with solids. Interest in these areas has exponentiated following presentations at ICCF-6 (International Conference on Cold Fusion) in Sapporro, Japan reporting significant nuclear transmutations of metals by LENR in solids. While still hotly debated, these results deserve strong consideration by ANS members.

Co-Chairs: George Miley (Univ. of Illinois)
Jim Patterson (Clean Energy Technologies). Panelists: John O'M Bochris (Texas A&M); Lali Chatterjee (Cumberland University); Tom Claytor (LLNL); Heinz Hora (UNSW); Russ George (Pacific Technology); John Dash (Portland State University); Dennis Cravens (Clean Energy Technologies).

Infinite Energy has learned that CETI may be bringing a demonstration hot water heating unit to the exhibit hall. (Reliable sources report that the units has been in continuous operation for several months at a power output range of several hundred watts, with excursions up to about a kilowatt. Also, there is an indication that the transmutation process applied to radioactive materials (thorium and uranium) for remediation purposes, will be demonstrated publicly at the meeting. Certainly, it is no secret that CETI has been granted a US patent for such a process (see *IE* #11).

For our part, we'd like to see the gloves taken off and a one-two punch delivered: *both* the water heater *and* the transmutation demonstrations.

The Pons/Fleischmann Patent Opposed by CETI at the European Patent Office

It was thought to have been a "done deal"—the *formal* granting of the Pons/Fleischmann patent by the European Patent Office—much as *Infinite Energy* had written in issue #4 in 1995. Indeed, on February 21, 1997, the clock was ticking and the patent would have automatically been granted had Clean Energy Technologies, Inc. (CETI) of Sarasota, Florida not challenged the granting of the patent in its present form. But CETI *did* oppose the granting on February 21, 1997.

Therefore, the granting of the Pons/Fleischmann Patent in Europe may have been held up at least for the next two years. ENECO of Salt Lake City, which owns the world-wide licensing rights to the Pons /Fleischmann patent, should it be approved, was most immediately affected. But affected negatively also were other cold fusion patent applicants in the US, hoping that a European granting of Pons /Fleischmann would break down the final barriers to their applications (see *IE*#11) at the US Patent and Trademark Office (USPTO).

This situation has caused quite a bit of consternation among many cold fusion supporters, to say the least. To witness two major and respected US cold fusion enterprises "fighting it out," for rights to the "trillion-dollar pie" will make opponents of cold fusion perceive the situation in one of two ways: (1) "See, we told you that the cold fusion people were *crazy*—they are now fighting over a worthless piece of paper governing a non-existent technology!" *or* (2) "Holy smokes! There may well be something to this 'cold fusion' after all, if commercial battle-lines have already been drawn so tightly." In all likelihood, the former opinion is more likely. But, just conceivably, "neutrals" and business people might find cause for a renewed interest in cold fusion—if they hear about this patent battle at all.

A lot is at stake, to be sure. Reports from informed sources at ENECO said that the company had tried, in vain, to forestall the opposition at the EPO by cutting a "sweet deal" with CETI—inas much as the Pons/Fleischmann patent has to be seen as a potential "umbrella patent" to which many other subsequent patents would be legally and financially subservient.

CETI's CEO, James Reding, grandson of Dr. James Patterson whose ordinary water electrolysis system and excess energy patents have been sailing through the USPTO via another branch of that organization (CETI now has 11 patents assigned), was reluctant to say much about the opposition matter. However, he did tell this Editor that he felt that the claims of Pons/Fleischmann, having been extended to cover the light water regime were now "too broad." He stated that he felt that the Pons/Fleischmann patent *should* be approved, but not with the broad coverage in areas affecting the light (or, more exactly, *ordinary*) water area.

It is interesting that a matter of scientific and technological importance—ordinary versus heavy water cold fusion systems—has apparently become the subject of a patent dispute!

Details Provided

Upon request, *Infinite Energy* received from ENECO the following clarification of the procedures that may be involved in resolving this matter between ENECO, CETI at the European Patent Office:

"On February 21, 1997, CETI opposed the granted Pons/Fleischmann European Patent on the grounds of lack of novelty and inventive step, insufficiency, and impermissible amendment.

"The following is an overview of the opposition procedure. The opposition procedure is initiated by the notice of opposition, which must be filed within nine months of the date of grant. The notice of opposition is supposed to include details of the facts, evidence and arguments relied on. In theory, the European Patent Office ("EPO") is entitled to refuse admission of additional materials later in the opposition procedure. In practice, however, materials not included when the opposition is filed can usually be

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admitted later if it can be shown that they are likely to have a significant effect on the outcome of the opposition. Indeed, materials can usually be presented right up to the day of the hearing if they are sufficiently relevant.

"The opposition papers are communicated to the patent proprietor. A period of 4 months is then set for the proprietor to file observations in reply. A two month extension is available as of right. The opponent will generally then be given a period of 4 months in which to comment on the patentee's observations. Again, an extension of two months will be available. At that stage, unless the opposition division identifies additional issues on which it requires the parties to comment, it is likely that they will come to a preliminary decision which they will send to the parties, together with a summons to a hearing. The preliminary decision will generally identify for the parties the issues that need to be considered at the hearing. It is quite common for the final decision reached at the hearing to reverse that in the summons.

"The hearing is generally informal. It is rare for a hearing to last for more than a day. In almost all cases, the parties are told of the decision of the Opposition Division at the end of the hearing, although the formal notification of the decision in writing may well not take place for another month or two. The Opposition Division may revoke the patent, reject the opposition, or decide to maintain the patent as amended.

"Overall, the time taken for the opposition procedure to be completed depends on the workload the people involved. Obviously, the time scale can be affected significantly by the speed with which the parties respond. The workload in the Opposition Division will also have a significant effect. The hearing will not likely take place within the next two years, unless one or both of the parıies move things along more quickly."

Atty. Paul S. Evans, ENECO
Salt Lake City

Our Favorite Oil Truck

With cold fusion, we may "not be in Kansas" any longer, but we are not out of the Oil Age—not yet. Recently, our local, and still-friendly oil dealer paid a visit to the home of your dear Editor-in-Chief in Bow, NH. While the technician was busy cleaning out our oil burner system, I was startled to note the very ironic vanity license plate—NO OIL—on the rear of his truck. (Don't worry about retaliation for this publicity, he's a "cold fusion man"—I convert everyone who comes to our home, or at least *seem* to convert them. They may really think we are mad, the way many *know-everything* academic physicists do!):

Ay-uh, Love New Hamp-shuh!
"No Oil or Die!"

A True Crackpot Physicist

Of all the bigoted, so-called physicists who have wantonly attacked cold fusion, without checking carefully the experimental facts, none has been more outrageous that Dr. Robert Park— the Big-Mouthpiece of the American Physical Society. We are gradually compiling a dossier of his nonsense that will form his damning epitaph. To be sure, he has become a cartoon of himself. Unable to get his mouth to link-up with his brain in reacting to the successes of the cold fusion/new energy field, he uttered this knee-jerk howler for a Reuters reporter's story on BlackLight Power, Inc. (see page 21):

"There is virtually nothing that science does not know about the hydrogen atom..."

Need we say more? Keep it up, Bob! Like fine wine, you are getting better (more hysterically preposterous) with age. Your epitaph grows and grows... Oh, by the way, there is a senior physicist at your Unversity of Maryland who has expressed an interest in trying to reproduce the Arata-Zhang helium work. Better stop him before he makes a fool of you...

BlackLight Power and Dr. Mills - *(Continued from Page 35)*

accepted by the scientific community."

Further, Reinhart Englemann, Professor of Electrical Engineering says, in part, "Mills's new 'classical' quantum mechanics is of beautiful conceptual simplicity and fully deterministic without the uncertainties, quantum jumps and probability functions of traditional quantum mechanics, without 'spooky action at a distance' [1]. This should be a pure joy for every searching scientist!"

In a political and economic vein, Shelby Brewer writes: "Remarkably, Dr. Mills has developed his theory and its energy generation application as an entrepreneur—without the largess from the US Government, and without the benediction of the US scientific priesthood. Because his enterprise does not suffer these two impediments, it just might succeed. If so, Mills will be the next Thomas Edison."

Even though Mills's energy process might be characterized as "SuperChemistry," he does allow that the shrunken hydrogen atoms, looking more like neutral particles, can facilitate some nuclear reactions. For example, in his book (pp.471-473), he cites some of BLP's own data that supports the production of tritium in heavy water electrolysis. If the Mills theory turned out to be the explanation for the excess heat in "cold fusion" systems, it would still be a fantastically powerful energy source—falling somewhere between ordinary chemical and nuclear reactions. Company literature states "a cup of water contains enough hydrogen to produce over 25 kilowatt hours of heat if you collapse the hydrogen atoms down to one-half their normal size. But collapse all the hydrogen atoms from a cup of water to one-twentieth their normal size and you can produce over 3,500 kilowatt hours of heat, or enough to provide all the energy needed for an average home—space and water heating plus electricity—for a month."

Dr. Mills, born in 1957, had been working on his revised quantum mechanics theory since the mid-1980s. He received his MD from Harvard Medical School in 1986, but was also taking electrical engineering courses at MIT, at which time his physical model crystallized. He states respectfully and specifically that he was inspired by the March 23, 1989 Pons-Fleischmann announcement. BLP literature also notes: "On April 21, 1989, less than 30 days after Pons and Fleischmann announced their cold fusion theory—Mills filed patents on the forerunner of the hydrino-fueled BlackLight Power process."

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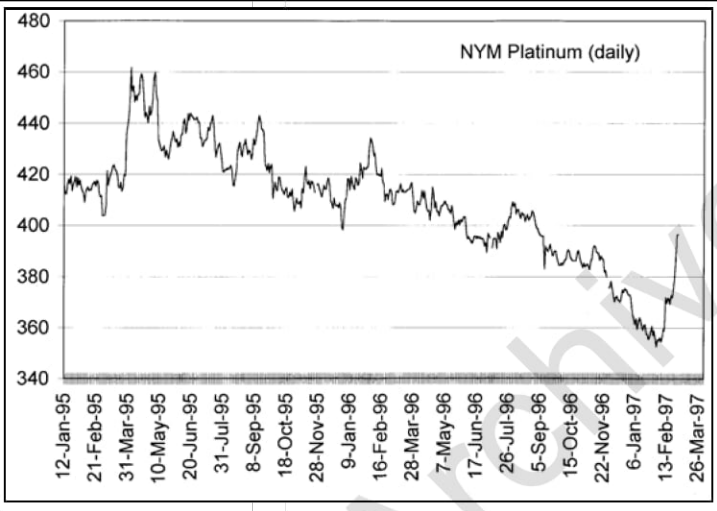

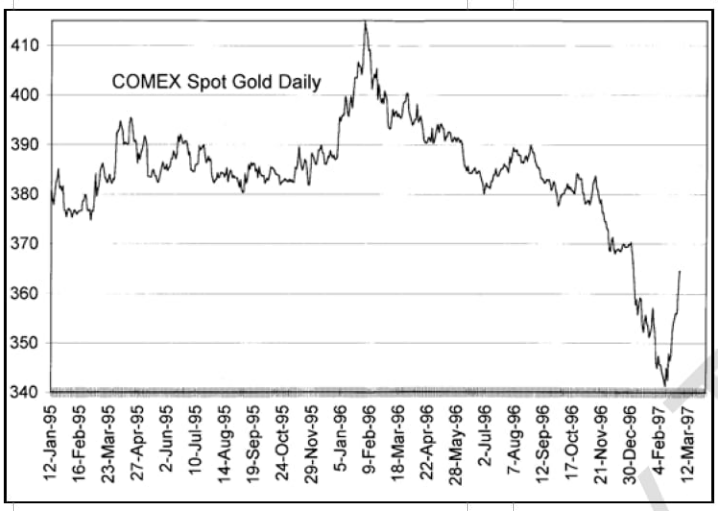

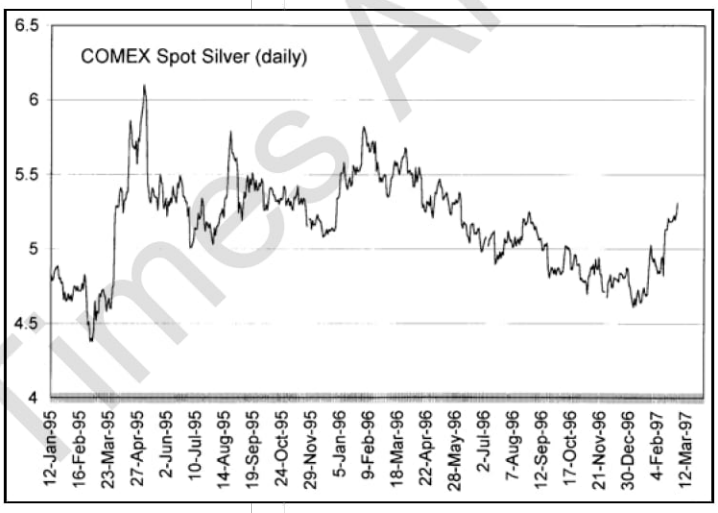

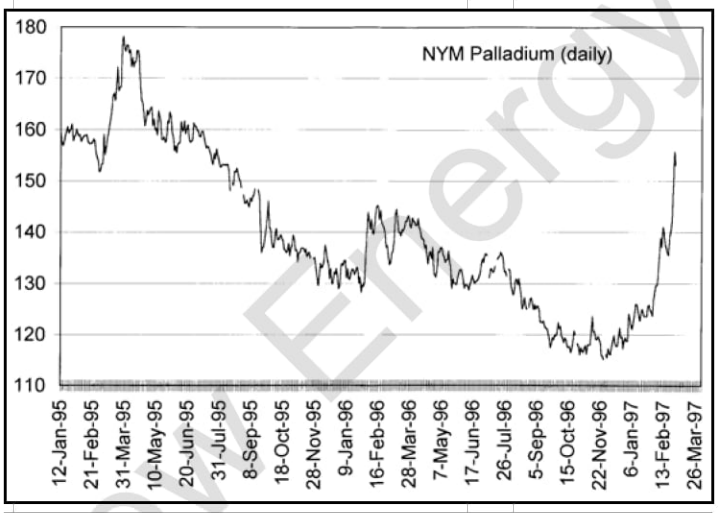

Recent precious metals price variations. *(Courtesy: Conrad M. Modica, Denver, Colorado)*

March 3, 1997

Dear Dr. Mallove:

Please find enclosed some charts **(ABOVE)** that I thought you might find interesting. As I have already stated to you in the past, I have been tracking palladium ever since I became interested in cold fusion.

As you can see by the chart, **palladium has had its most violent rise since I have been tracking it.** [Editor's bolding.] What's interesting is that the latest rally in precious metals has been triggered by palladium. None of the other precious metals have done nearly as well in this last bout of buying.

The story from the press is that the Russians are causing a supply squeeze. From my own experience of being a precious metals analyst and writing a financial newsletter covering events in these markets (I have since discontinued my letter), the press is full of misinformation. I really can't say what's been causing the rise. And the charts only tell a minor part of the story.

What's always in the back of my mind is what's happening in the cold fusion arena— if that has actually had an influence. I would really have no way of telling since the commercialization of CF is really not covered in detail in your magazine. I wish you would cover more if it. *[Editor's Note: And we thought we were covering that well enough! — OK, more business news, coming up!]*

Separately, I commend you when you cover items in your magazine exposing how certain free energy claims have come up empty, like the Potapov device and the Sciex scooter. [Ed. Note: At least *so far* on these.] It really shows that you are objective and approaching things in a well-reasoned, scientific and journalistic manner. By writing more about the hoaxers, you show your readers that, while free energy would be the greatest blessing to mankind, you are not willing to compromise your publication and deceive those who comprehend the dream.

I think you are doing a great job with your magazine. It really gives me something to look forward to in the future and makes me glad that there are people like you around. I just wish you would tell us more about what's happening with commercialization, which you have made it sound as if it's right around the corner. I have been an electrician for many years and have always imagined what it would be like if energy were free.

Regards, C.M. Modica

Conrad, We thank you for this enlightenment! CF commercialization IS "just around the corner." Keep the faith!—EFM

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WEIRD MEET AGAIN

By Susan Seddon

The weather was all wrong.

There should have been thick, swirling fog and the muffled echo of a slowly retreating horse-drawn hansom. Instead, it was a bright, chilly Sunday morning in Old London Town, not at all an appropriate setting for the *Fortean Times* Annual Weirdfest.

I sat, for a while, in a cafe opposite the lecture hall observing the gradual arrival of the "UnConventioners," and a less motley crew would be hard to imagine. Someone, it would appear, had unloaded a job-lot of black (with grey alien motif) sweatshirts onto this crowd. I couldn't believe for a second they were all wearing them for a bet. My neat little business suit suddenly seemed surplus to requirements.

I caught a brief glimpse of Chris Tinsley, peering out through the black/grey swarm. He wasn't so much wondering where I had disappeared to, as nervously pondering whether I had managed to find a green-grocery.

I hadn't. So he could relax in the secure knowledge that I would not, as threatened, be sitting in the front row sucking lemons at him throughout his presentation. Of course, he wouldn't know that until he started speaking.....

I decided I would enter the lecture hall only after I had counted two hundred Schwa sweatshirts....half a minute later I was in there. I flashed my admission badge to the yeti on Reception and sauntered downstairs to check out the merchandise.

I was right about the business suit. It certainly had an unnerving effect on a small knot of conspiracy theorists, who were happily declaring their paranoic patronage of all things clandestine until I stood behind them. Their previously-booming voices became whispers, and they shuffled nervously away from me. Clearly, I was to be regarded as one of the "women in black."

He was surprisingly good. I was almost impressed.

When chasing them around the room became boring, I peered into the lecture hall where Tinsley was holding court. His talk on **"Cold Fusion - and perhaps a New Physics"** apparently had them rolling in the aisles—or maybe he'd tripped over the microphone wires again.

Certainly the audience of several hundred souls appeared to be enjoying his presentation. The majority gazing up at him with rapt and serious attention, something I never could get the hang of myself. I decided to check out the opposition. At the same time as Tinsley's talk a guy named Richard Wiseman was in an adjacent lecture room carefully explaining how the Indian Rope trick was performed. He obviously did know, and had presumably been giving practical demonstrations to a hundred or so members of his audience. It was certainly quiet in there.

Eventually, I supposed, I'd have to show my face in the CF lecture.....but not yet.

The Media Room was Yeti Central. I recall thinking it odd that the convention organisers found it necessary to send speakers a photograph of their Press Officer to aid recognition. The man had clearly taken hirsutism to its very limit and would certainly stand out in a normal crowd. But, this was no normal crowd.

He smiled at me ..... I think.

Outside the lecture halls were several stands selling all manner of cryptocrud, including those splendid black and grey sweatshirts. I had to fight against the overwhelming urge to buy a few for Christopher— they were strangely compelling garments—perhaps they bore a subliminal message within the fabric..... "Buy this shirt/Grow a beard." That would explain a lot.

I had just decided to brave "Cold Fusion - and Perhaps a New Physics" when there was a PA announcement: "Are there any doctors here?." I was almost killed in the rush. Sadly though, the four or five guys who had dashed so fearlessly towards the Reception desk shuffled away looking somewhat sheepish. There was a second announcement: "Are there any medical doctors here?"

I decided to show willing and listen to the end of the CF lecture. Not that I find the topic boring, of course, but I did write down the presentation. **[Editor's Note: WE *may* very well print an edited-down transcript in the next issue of *Infinite Energy* if the T^2 (Tinsley Talk) is weird enough for our audience—*EFM*]** Well, I actually re-wrote Tinsley's notes in very large letters, so that he could refer to them without wearing his Hubble telescope strength spectacles.

He was surprisingly good. I was almost impressed. All of his original audience were still in their seats - apart from one guy who bolted from the room so fast, it could only have been a dodgy curry the previous evening — but the rest of them were inert as statues and obviously quite enthralled.

He thwarted the career prospects of an aspiring techno-heckler with the surety and aplomb of a politician and—for his final trick—turned an American lady scientist's face a rather fetching shade of purple.

The man is not only a piranha amongst public-speakers, he's a pretty good ambassador for cold fusion too.

The Wall Street Journal prints Mallove letter 31 March 1997

Fusion Confusion Runs Hot and Cold

In your Feb. 28 Marketplace article "How Do We Know Dolly Isn't a Hoax?" you accomplished an amazing feat of alchemy in science writing when you managed to offend both the hot fusion establishment and the cold fusion community. Referring to nuclear fusion as a "cataclysmic reaction that normally occurs on the surface of the sun," you made an egregious error. As far as is known, there are no nuclear reactions occurring on the surface of the sun, which is a mere 6,000 degrees Celsius. If fusion reactions were occurring there, that would be cold fusion, indeed, compared with the several hundred million degrees that the hot fusioneers at Princeton and elsewhere require in their costly, technically bankrupt machines. The sun's fusion reactions occur deep within its core, as every student of astronomy knows.

By contrast, the still mysterious but real and powerful "cold fusion" reactions in water-based electrolysis systems, now being developed for commercial application both in the U.S. and abroad to replace fossil fuels (and government-supported hot fusion), involve temperatures from room temperature to only several hundred degrees.

In an appalling slip, you say that "no one has been able to conclusively duplicate the (Fleischmann and Pons) experiment." That should rile hundreds of cold fusion scientists, especially the group of Dr. Michael McKubre at SRI International, who wrote the final Electric Power Research Institute Report (TR-104195, August 1994), which states that Fleischmann and Pons were absolutely correct. Also, at the Sixth International Conference on Cold Fusion in Japan last October, a member of the French Atomic Energy Agency (C. Lonchampt) reported a full production of the boiling cell cold fusion result of Fleischmann and Pons described in Physics Letters A, 176 (1993)

This careless abuse of the facts on so important a matter as our emerging energy future is inexcusable. What are you going to tell your fossil-fuel industry readers when they learn that their obituary has already been written by carefully documented, meticulous experiments that show that there is something, indeed, very new under the sun?

Eugene F. Mallove, Sc.D.
Editor-In-Chief
Infinite Energy Magazine

Concord, N.H.

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WIZARD: The Life and Times of Nikola Tesla Biography of a Genius

by Marc J. Seifer (Birch Lane Press, Carol Publishing Group, 120 Enterprise Ave., Secaucus, NJ 07094) 1996.
ISBN 1-55972-329-7 (Hardback, US $32), 543 pages

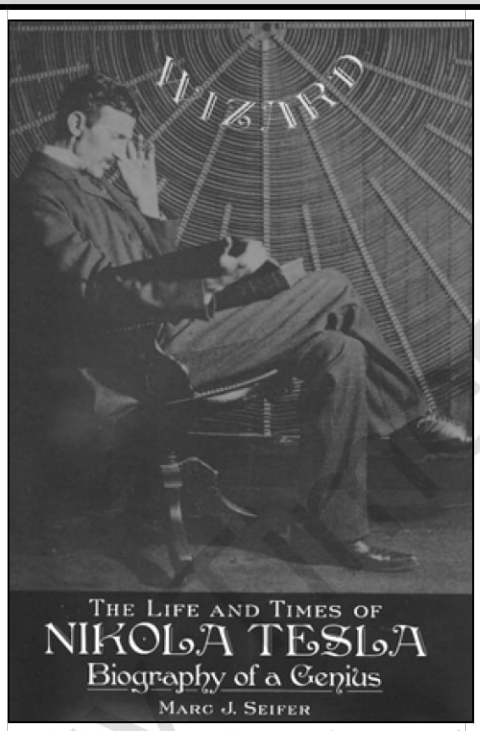
***Reviewed* by Jeffery D. Kooistra**

As a veteran of several other biographies of Nikola Tesla, I eagerly anticipated the arrival of *Wizard: The Life and Times of Nikola Tesla, Biography of a Genius* by Marc J. Seifer. I fully expected it to be the best biography done on Tesla to date. I'm happy to report that I was not disappointed. Although not what I would consider the perfect Tesla biography to be (which it would likely be impossible to write for at least another hundred years anyway), a properly annotated edition of this one would come darn close. But more about that later.

The book is nicely laid out chronologically, clearly and engagingly written, decently footnoted, and corrects errors and excesses from previous biographies. The author interviewed people who knew Tesla, combed through acres of correspondence, and made judicious use of the Freedom of Information Act to give us the best account yet of who Tesla was and what he did and why we should care. In short, Seifer demonstrates not only that he knows how to do research, but that he actually did it, too.

Critics will no doubt complain that the book is "pro-Tesla," but so what? It's hard not to be when one considers the range of the Wizard's genius. In terms of sheer inventive brilliance, Tesla was preeminent, towering over even Edison. However, Seifer doesn't shy away from demonstrating Tesla's grotesque lack of business acumen, which Edison and Marconi had in spades and which is why everyone has heard of those two and why the name of the man responsible for all those AC electrical outlets in our homes is almost unknown to the general public.

For those who don't know, Nikola Tesla invented the "brushless," or induction motor. I have several downstairs driving power tools in my shop. Tesla also invented the polyphase AC power system that we so take for granted, and he and Westinghouse had to go to war with Edison to get AC adopted over DC, this despite the obvious superiority of AC for distant power transmission. (Ah, but you see, there was a lot of money already tied



up in DC. Money issues color accepted history a great deal— a point you can't fail to miss in this book.)

Tesla invented radio. History books still give Marconi credit despite the ruling in 1943 by the Supreme Court that Tesla was the legitimate inventor. Marconi infringed on Tesla's patents, particularly the one of the four tuned circuits central to all radio communication, but also on those of many others. Still, Marconi made the news and had the backing, and so to this day gets the credit.

There's much more. Tesla also invented fluorescent lighting, but he didn't adequately pursue bringing it to market. He invented robotics and radio remote control, controlling a small boat by radio signals before the turn of the century. He invented an ingenious bladeless turbine engine/pump which was unfortunately ahead of the materials science of the day and so couldn't be made into a commercial product (though work continues today.)

All of this still only scratches the surface of Tesla's inventive legacy. He should have died a billionaire. Instead, he died penniless and alone, save for his eccentricities and his pigeons, by and large forgotten by a technological era that he was instrumental in bringing into being.

Why?

That's a hard question to answer. It certainly was not because Tesla was only a minor luminary in his own day. He was a regular on the "party scene" in the gay nineties. Mark Twain was a friend, and Tesla had shared meals with Kipling. He'd spent a great deal of leisure time with his friend, the famous architect Stanford White, who also designed Tesla's famed Wardenclyffe facility. Tesla was in partnership at various times with George Westinghouse and J. P. Morgan, and worked briefly for Edison and was his rival for decades. Of interest to the "Greens" among the *Infinite Energy* readership, Tesla was even buddies with the famous John Muir.

It was also not because he wasn't well known within the scientific community. For instance, in 1892 Tesla gave a lecture in London before the Royal Society. In attendance were such famous names as J. J. Thomson, Oliver Heaviside, Sir John Ambrose Fleming, Sir James Dewar, Sir Oliver Lodge, Sir William Crookes, and Lord Kelvin. (Seifer relates the delightful story that after this lecture Dewar took Tesla around to "show him the sights," including Dewar's own lab. There, according to Tesla, the Scotchman "...pushed me into a chair and poured out half a glass of wonderful brown fluid which sparkled in all sorts of iridescent colors and tasted like nectar." "'Now,' Dewar declared with a twinkle in his eye and a grin that brought one of reciprocation on the face of his captive, 'you are sitting in Faraday's chair and you are enjoying whiskey he used to drink.'").

One reason we can note to help account for Tesla's current obscurity is the fundamental nature of many of his early patents, and the financial incentives for both other inventors and their financial patrons to downplay Tesla's role in the development of AC power and particularly radio technology. Tesla's fellow Serb, the famed engineer Michael Pupin, would barely mention Tesla in the electrical engineering

New Energy Archive

classes he taught, and Steinmetz would virtually exclude Tesla's name from his own books about the development of electrical technology. Marconi himself had his own radio patent in the US rejected three times by the patent examiner as not being sufficiently different from Tesla's earlier work. He had to wait until that examiner moved on before his patent was approved. Seifer spends a significant portion of the book detailing these sorts of less-than-virtuous but typical behaviors of the day (which haven't disappeared a hundred years later).

But perhaps the ultimate reason for Tesla's obscurity was his own obsessive nature, pursuing to the end of his days his dream of bringing wireless power transmission to the whole earth, to the exclusion of putting the finishing touches on other work that could have netted him several fortunes.

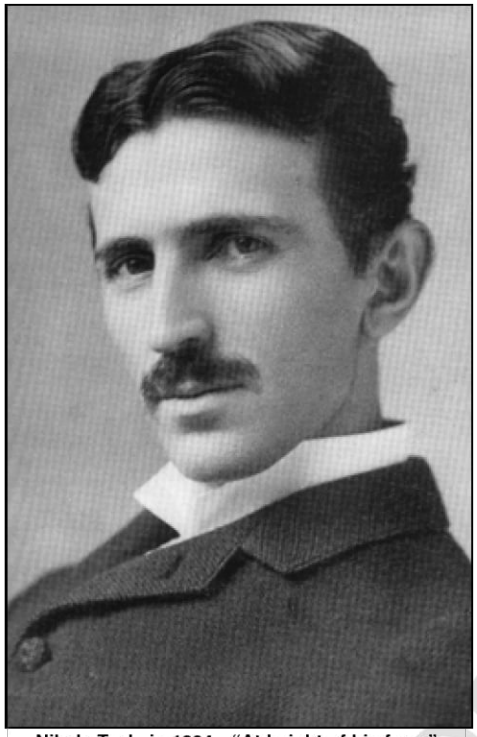
The story of Wardenclyffe is a sad one. For some, it is sad because they believe the project never had a chance of working anyway. For others, sad because Tesla really did have it in his grasp to power the earth, but his stupid business dealings with Morgan and his own grandiose ambitions ruined him.

Because the Wardenclyffe facility (or World Telegraphy Center) was so important to Tesla, Seifer spends a good deal of time with it. For this reader, he also does far and away the best job among Tesla biographies of explaining just exactly what Tesla had in mind, and how the system was supposed to work.

At a time when just sending morse code across the ocean was considered a great feat, Tesla conceived, designed, and began to build a system that would transmit secure multi-channel voice messages to anyplace in the world. But more than that, he intended to send, wirelessly, electrical energy as well, and in the fully realized system, enough to power heavy machinery, ships at sea, and even planes in the air.

There is a good deal of confusion about Tesla's scheme these days because we automatically associate wireless power transmission with microwaves and rectennas. Tesla had no interest in such methods and in his scheme, ordinary electromagnetic radiation is considered a loss to be reduced. Tesla planned to send power through the earth.

Imagine an elastic sphere filled with water, and on this are several small pistons. If one piston is alternately shoved in and out, the other pistons scattered around the sphere will also respond and move in and out. In the Wardenclyffe case, Tesla wanted to pump energy into the earth at the natural resonant earth frequencies, and then properly tuned



Nikola Tesla in 1894—"At height of his fame"
(Courtesy: Mark J. Seifer)

receivers would be able to tap into this energy. For over-unity buffs, there is a great deal of evidence to suggest that Tesla planned to extract much more energy out of the earth from the receivers than was put in at the transmitter.

Seifer gets the usual feedback on this system from scientists today, some who think the system would have worked, and others who don't (but more about that later).

Whether or not the system would have worked as specified is moot as far as the rest of Tesla's life is concerned. At a time when J.P. Morgan wanted nothing more than simple radio telegraphy, Tesla deliberately took Morgan's money and began building his own system. There came hard financial times during the construction (perhaps engineered by Morgan himself), and Tesla's bills far outstripped his capital, and Morgan refused to advance additional funds.

Wizard is loaded with excerpts from Tesla's letters to Morgan, begging, pleading, castigating, lecturing the Tycoon in an attempt to gain additional funds, but to no avail. Seifer, whose training is in psychology, believes that Tesla suffered a nervous breakdown at this point in his life (1906), something not discussed in other biographies.

Tesla embarked on a long campaign to find other investors and to raise the money to get Wardenclyffe up and running. He even invented his marvelous bladeless turbine engine, in the hopes that this device would supplant the engines of the day and make him wealthy enough to, of course, pursue the Wardenclyffe dream. Meanwhile, other radio pioneers were sending morse code across the ocean, and putting transmitters on ships, and fighting with themselves and Tesla over patent priorities. Far less capable, but genuinely working radio towers began to be built.

Eventually, the Wardenclyffe tower was torn down.

The rest of the book deals with what Tesla did in his later life, recounting many of his annual press conferences in which Tesla would make grand claims about his current work and what the future would bring. Most of these claims cannot (yet) be substantiated, but Seifer provides more than enough evidence to show that Tesla's proclamations at these conferences cannot be lightly dismissed (for instance, there is telling evidence that the old Soviet Union specifically used a later Tesla invention, his "death ray," to develop it's own particle beam weaponry).

One late chapter discusses the FBI and the Tesla papers at the time of the Wizard's death.

Although the official story is essentially that Tesla didn't leave much behind in his numerous trunks and papers that was worth keeping, Seifer presents convincing evidence that much of this "worthless" material has been classified and kept from the public eye to this day.

There is a brief appendix about Tesla's magnifying transmitter, the key device in his world wireless power scheme. Would it work? Here is where I have one nit to pick with Seifer. In addition to asking such experts as Eric Dollard and James Corum, two people who have actually duplicated some of Tesla's devices and conducted experiments, for their opinions (both conclude the scheme could have worked), Seifer also includes the opinions of an electrical engineering professor from Brown University by the name of Kornhauser, who is doubtful about the likelihood of success. I don't know Dr. Kornhauser, but unless he is also a Tesla scholar, whether or not he is an electrical engineer is irrelevant to his opinions about Tesla technology, every bit as irrelevant as your typical physics professor's opinion about cold fusion.

But I confess, this is a trivial thing, and it will help the book sell amongst the unilluminated masses of the scientific establishment, who desperately need to know more about Tesla (which might save some of them from reinventing wheels Tesla made a century ago).

At the top of this review I said that a properly annotated version of this book would make it darn close to the perfect Tesla biography. Simply running through the many footnotes supplied by Seifer reveals numerous, tantalizing glimpses into experimental work and theorizing done by others about Tesla and his work. Rather than just footnotes and brief comments contained within the text, it would be a towering achievement to produce a biographical volume where technical sidebars and appendices by the likes of Dollard, James and Kenneth Corum, and

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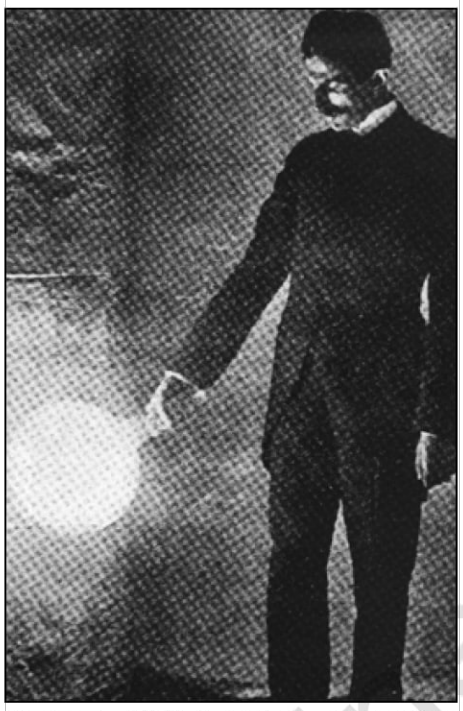
many other researchers, who have built hardware and conducted experiments, were included. Such a book would not only serve as an introduction to Tesla, but would also allow the prospective experimenter the chance to find which area of Tesla's work he might like to explore himself, and enough information to actually begin.

This is high praise. If *Wizard* were not such an excellent biography already, I wouldn't make such a suggestion. Of course, such an expanded book would intimidate the average reader who Seifer is trying to reach. But for us Tesla lovers....

The bottom line is that if you're looking for just one Tesla biography to read, *WIZARD* is your best bet.

One more thing, this about the title.

Another excellent biography I've read in the past few years is *GENIUS*, by James Gleick, about the life of the brilliant physicist Richard Feynman. Feynman had quite the reputation himself, and many other physicists considered him a "magician." See, many geniuses arrive at their solutions by means of great mental power, but we ordinary Joes could get there too if we were only a whole lot smarter. Then there are the magicians like Feynman, who sometimes arrive at solutions (Feynman diagrams and all that QED stuff) by paths that are impossible to reconstruct. They pull rabbits out of their hats and no one knows how the trick is done. Still, it is a trick, and there are other ways to get rabbits out of hats, which is why Feynman shared his Nobel prize with Schwinger and Tomonaga.



Nikola Tesla with his "cold wireless lamp" without filament. *(Electrical Review, 1898 —reprinted from* Wizard)

But Tesla was a wizard. He really could do magic.

Book Review:

Gravitational Force of the Sun

Author: Pari Spolter; Publication Data: Orb Publishing Co., Granada Hills, CA, 1993, ISBN 09638107-5-8, Hardback $29.95.

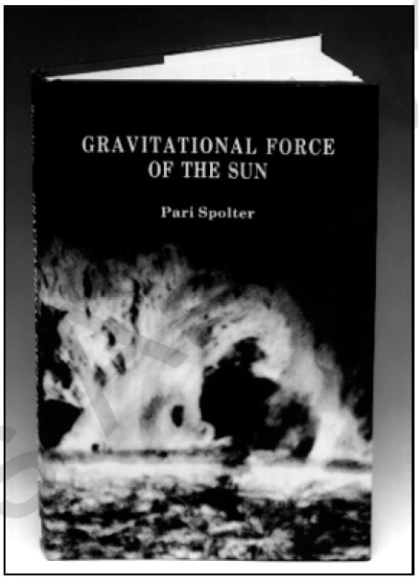
Reviewer: T. E. Phipps, Jr.

This book provides a unique testament to independent thinking in the sciences — both its virtues and its pitfalls. It is no news that independent thinking is a very rare commodity among trained scientists ... probably a good deal more so than among the lay public at large. The aim of "training" or of higher education in general is, while making the obligatory profound genuflections to original thought, to ensure that as little of it as possible actually happens. In this the training is surprisingly effective. By and large, the professors succeed in intellectually cloning themselves — at least among the subset of the instructed whom Mater Academia blesses by gathering to her nurturing bosom. Among these mutually-admiring replicas of the pedagogic personality is not numbered Pari Spolter.

Two of her chapters are devoted to a penetrating and well-documented attack on Einstein's theories of relativity. She gives evidence of having been well trained in the arcana of that subject but not brainwashed into submission. Yet her opposition to the trendy is no automatic endorsement of the traditional: Newton's approach to the description of gravity is served with its equal helping of criticism. It is clear from the outset that the author is more in tune with Kepler than with most of the watchers of the heavens who have followed him.

The author's scientific antecedents are unclear. The book jacket tells us she has a doctorate and has published in biochemistry and is a member of the American Mathematical Society. It is striking, however, how well informed she seems to be in the field of astronomy or celestial mechanics. At least she has the language down pat and can meridian and apside with the best of them. As a physicist, she may be somewhat lacking in formal preparation; but the topics she treats are so fundamental that more preparation might merely stand in her way (see above).

Still, her originality is so excessive that timid intellects like mine tend to recoil from some of her insights (e.g., "the rotation of the star generates the gravitational force.") Certainly, one longs to argue with her on some of her more cherished points. That is the weakness of the printed page: One cannot argue with it, but must take it or leave it. Often one leaves it with the likelihood of some profound misapprehension about what has been said. It would seem



that she seeks to overturn much of the wisdom of the ages, including some old-fashioned prejudices about units and dimensions. Instead of $F = ma$, she has $W = ma$, where W is weight. You may think that is a mere student howler, but no, she works out its consequences in consistent detail, premised on acceptance of the newton as a unit of weight rather than force. Kepler's third law is expressed as $F_s = aA$, a constant, acceleration a being v^2 / r, A being orbital area, πr^2, and F_s. being the "gravitational force of the Sun," measured — I kid you not — in units of the (Spolter sub $_c$). [One wonders: If "gravitational force" is a constant, why are all planetary systems of limited spatial extent?] Some of her innovations (such as a definition of eccentricity as "the ratio of the sum of perturbations to the gravitational force of the sun") may well prove productive; others seem really beyond defense; in particular the idea of a "critical mass": She pictures a 1-kg mass on a "horizontal frictionless surface," being pulled horizontally via a spring with expenditure of a certain finite amount of energy. If the 1-kg mass is replaced by 1000 kg, she says, the "critical mass" is exceeded and the mass will not budge at all. One wants to argue here that the critical issue (not mass) is how "frictionless" the surface is. But, as I say, it is a feature of the printed page that it brooks no argument. The book, be it noted, does not aim at complete self-sufficiency, but anticipates a sequel, *Gravitational Force of the Proton*.

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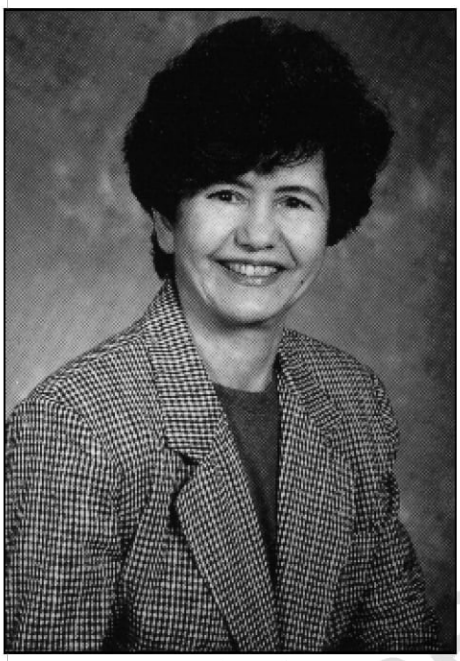
Why should anyone not a relativity dissident or other eccentric bother to read a book so delightfully quirky in some of its premises? Well, let me give one reason why I think this book constitutes an important milestone in both physics and astronomy. There are sure to be other reasons that will strike other readers. But what struck me is that here the validity of that shadowy, notorious Bode-Titius "law" — a quasi-empiricism describing an apparent regularity of planetary spacings, which has been endorsed by Petr Beckmann (*Einstein Plus Two*, Golem Press, Boulder, CO, 1987) and many others over the centuries—finally is made so compellingly clear that nobody with an ounce of objectivity can fail to miss it ... nor fail to suspect that new mechanical principles are needed to describe it.

...at any epoch the most important prerequisite for the progress of science is assured recognition of what is <u>not known</u>...



Dr. Pari Spolter

Not only do the spacings of the Sun's planets (including major asteroids) fit the general form of the law, but equally well, with fitting correlations upwards of 0.99, the spacings of dozens of newly-discovered satellites of the major planets fit the same law.

This is of the form $r = AB^n$, where r is mean radial distance of the satellite object from its co-rotating force center, A and **B** are constants different for each planetary or satellite system, and n enumerates a sequence of (generally successive) integers that label successive stable (near-circular, near-coplanar) satellite orbits. Unfortunately, our knowledge of celestial mechanics is so primitive that we cannot predict the numerical values of *A, B,* but must find them empirically by curve fitting. It would appear that we do not even know the descriptive principles that might guide such prediction. (There is a rule about observed retrograde rotation sense of far-outermost satellites that likewise defies reduction to known art.) Apparently there are facts of mechanics that lie outside any known system of mechanics. The new data for the surprisingly (to this ignoramus) many newfound "moons" of Jupiter, Saturn, etc. seem statistically overwhelming. From the author's data, one must feel as sure that some missing mechanical principle validates the Bode-Titius law as that the sun will rise tomorrow.

There is much more of outstanding value in the book than I have been able to suggest here. (To name the least, there is an appendix in which the rotation of the earth is treated via translations of the superb original writings of Foucault on his famous pendulum and his invention of the gyroscope.) But if this book did no more than to provide the persuasive evidence it does for the Bode-Titius law, it would deserve a place of honor in the pantheon of the history of science. For at any epoch the most important prerequisite for the progress of science is assured recognition of what is *not known*: the dropping of the veil of illusion that hides the dread necessity for new conceptualization. Pari Spolter teaches us here, through our manifest ignorance of what lies behind the Bode-Titius law, that for all the boasted beauty of our string theories and the brassily-resounding immodesty of our Theories of Everything we still stand barely toe-deep in Newton's ocean.

(This review may be excerpted in a forthcoming edition of <u>Galilean Electrodynamics</u>, 141 Rhinecliff St. Arlington, MA 02174)

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SPACE ENERGY RECEIVERS—<u>Power from the Wheelwork of Nature</u>. Space energy receivers are defined as devices which apparently collect electrical energy from the surrounding space without applied force, by some process other than chemical or mechanical action. This booklet describes eight inventors and their devices, covering the years 1901 to 1945. Send $8.50 (postpaid) for US and Canada; $10.00 overseas, to: Simplified Tech. Service, P.O. Box 2140A, Champaign, IL, USA 61825

Segner-Marinov from page 71...

where, I repeat, μ is the water mass squirting out from the Segner-Marinov turbine in a unit of time when its friction (or load) torque is equal to $M_{dr\text{-}net}$.

Of the net power P_{net} 83% will be delivered to the Segner-Marinov turbine and 17% to the Pelton turbine.

Which conclusion can we draw when analyzing the physical essence of the Segner-Marinov turbine? Obviously the conclusion is only one: Mankind which during centuries constructs water dams whose dimensions and costs can be compared only with those of the Egyptian pyramids is nothing else than a herd of blind. The non-utility of these dams can be compared only with the non-utility of the pyramids.

Let me note that on the construction of the world's biggest dam on the river Jangtse in China every day 20,000 men work, including Saturdays and Sundays, and will work for the next 20 years. A thousand villages and a town of 300,000 inhabitants will be devoured by the artificial sea, whose length will be 800 km. If the future dam should be destroyed by an earthquake or by a bomb, Nanking and Shanghai would disappear from the map. With the present article I put a cross over this enterprise of human imbecility.

2. EXPERIMENT

There was (Figs. 3 and 4) R = 5.4 cm, H=12 cm. The water streaming out at the rotational velocity $\Omega = (2gH)^{1/2}/R$ = 28.4 rad/sec= 4.5 rev/sec was V= 70 cm^3/sec, so that the net driving torque was

$M_{dr\text{-}net}=\mu\Omega R^2V(\sqrt{2}-1)$ = 24,011 dyne.cm ≈ 24 pond. cm.

As in the real apparatus the water paraboloid reached the bottom not at its centre but at a distance r_0 = 1.4 cm from the center, the rotational velocity was a little bit larger. On the other hand, the distance between the rim of the axial tube and the inner border of the cylindrical recipient was not 2 mm, as in the figure. The initial construction with this distance turned out to be unfit, as water went over the internal border of the cylindrical recipient, and the latter was enhanced with 4 mm, which led to respective enhancement of the nozzles. Thus the actual net driving torque was less but in the order of 20 pond.cm.

The friction torque evidently was larger, as the machine could not maintain eternally its rotation. However, by making coast-down measurements, first when the machine worked as a Segner-Marinov turbine and then when the turbine's nozzles have been plugged and the same paraboloid formed, the times 3 min, 38 sec and 1min, 08 sec were measured, which was a clear indication that there was a driving torque acting on the Segner-Marinov turbine.

If instead of water, mercury were used in the turbine, the torque would be 13.5 times larger and the machine surely would rotate as a *perpetuum mobile*.

REFERENCES

1. S. Marinov, *Deutsche Physik*, 5(19), 22 (1996).
2. S. Marinov, *Journal of New Energy*, 1(2), 130 (1996).

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ENERGY GAIN AND NUCLEAR TRANSMUTATION BY LOW-ENERGY p- OR d-REACTIONS IN METAL LATTICES

Heinrich Hora, J.C. Kelly, and G.H. Miley*
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***Fusion Studies Lab., University of Illinois, Urbana, Ill. 61801, USA**

Abstract

Since reproducible experiments with varying amounts of energy production from nuclear fusion and nuclear transmutations by protons or deuterons in high concentrations in host metals have been shown, some conceptual problems are discussed. We underline here the steps how the experiments for using the swimming electron layer for reduction of the Coulomb repulsion were motivated with using nickel or palladium-nickel single or multiple layers. In support of this we evaluate the experiments by Arata et al and confirm on the basis of our earlier derived power law that the reaction distance of the deuterons (or protons) is in the range of few pm. We further evaluate the measured distributions at transmutations of the elements on the atomic number Z and find an exponential law for the decay of the maxima on Z. The result of transmutation of the host metals is generalized by actively adding other nuclides into the near surface or interface for inducing desired transmutations. These reactions with added materials may be used for a low cost elimination of long lived nuclear waste and of the abolition of plutonium.

1. DIFFICULTIES IN COLD FUSION

Paneth in 1926[1] had reasons to conclude that deuterium, dissolved in high concentration in palladium, had been reacted to helium. Such nuclear reactions were unthinkable at this time and the reported results were disclaimed later. Suggestions of such kinds of reactions[2] would have been completely ignored by the scientific community if indications had not been reported[3] that palladium with high deuterium concentrations may emit fusion neutrons above the background level, and if there had not been reported the generation of large amounts of energy from the same systems[4], which received public attention.

This phenomenon of "cold fusion" has been studied since by several competent and a large number of less competent projects. The confusing results may not be surprising if one considers the the history in another case: the explanations for Bequerel's discovery of radioactivity a hundred years ago until Ernest Rutherford found the solution by distinguishing α-,β-,γ-rays. Even then it happened—since attempts to explain Bequerel's discovery were mostly considered to be unscientific—that Rutherford came close to being dismissed from his faculty of MacMaster's University and was saved only by his invitation to Cambridge.

Fleischmann and Pons' experiment was indeed not fully reproducible. As was underlined by Morrison[5] (CERN), with regard to the experiments generously funded by Toyota, it needs to be explained why the laboratory with Fleischmann and Pons in France produced excess heat while simultaneously all cells in the laboratory of the same organization in Sapporo did not produce any excess heat. The other laboratory in Sapporo which was well funded by the Japanese MITI bought 20 cells from S. Pons and despite 4-weeks of work by Pons, none of the cells produced heat.

In this situation it is important to refer to the very sophisticated measurements of Claytor et al[6] (Los Alamos National Laboratory) of the generation of tritium in deuterated palladium: 99.9995% pure palladium did not produce any tritium, while PdRhCo 5%5% had a tritium production linear with time during 130 hours, with some bursts. Similarly, heat production was carefully studied by Miles et al[7] and it was found that it did happen reproducibly, but there was a strong systematic difference depending on the kind and of the amount of other metal concentrations in the palladium.

In addition to this, other kinds of experiments with nickel or palladium filled with hydrogen, generated heat[8,9] in a reproducible way and resulted in the generation of elements by nuclear transmutation, as seen from the ratio of the isotopes which deviated from the natural ratio. Contamination could be excluded since elements such as uranium were produced, which definitely was not in the surroundings. Similar transmutations were observed in fundamentally different experiments[10] where, however, as in the forementioned cases no accompanying nuclear decay products were detected— at least with the applied instrumentation. One exception has been reported: that a well-identified radioactive platinum isotope was generated, as measured by its half life.

2. BACKGROUND FOR THE POWER LAW OF REACTION DISTANCE

The experimental studies of the low-energy nuclear reactions induced by hydrogen or deuterium in high concentrations in host metals were guided by the discovery of a semi-empirical power law for the probable reaction time depending on the nuclear distance. This may be explained within the scope of considering some other observations in order to provide a realistic view about the phenomenon. Such an example is the measurement[11] of the fully reversible emission of DD-fusion neutrons of 20 times higher level than the background from deuterated KD*P-crystals (KD_2PO_4) when going up or down with the temperature of the phase transition (213 K). The assumption that the phase transition produced cracks etc. which accelerate deuterons to the energies of the hot fusion can easily be excluded from the fact that 10^8 times more tritium atoms were produced than neutrons emitted.

The proof is based on the following result. At hot fusion with energies of more than 5 keV, the well known reaction is

$$\begin{aligned} d + d &= {}^3He + n + 3.27\ MeV \quad (R_n = 50\%) \\ &\ t + p + 4.03\ MeV \quad (R_t = 50\%) \\ &\ {}^4He + g + 23.7\ MeV \quad (R_{4He} = 10^{-6}) \end{aligned} \qquad (1)$$

If the deuterons react at an impact energy near or above 1 eV it has been measured first by Bockris that much more tritium is produced and from measured net energy gain, much more ^4He should be produced, just the values which need to be gathered more accurately from experiments as that with KD*P

$$R_n = 1;\ R_t = 10^8 \text{ to } 10^9; \quad R_{4He} = 10^{11} \qquad (2)$$

These reaction rates differ from that of the hot fusion values and agree with the measurements[11] in KD*P corresponding to cold fusion.

Having explained this experiment as a serious proof for the low-energy nuclear reactions, we underline now the steps we have followed up under motivation by the following theoretical assumptions. We

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assume that the hydrogen or deuterium in the host metals (palladium, titanium, nickel, iron, thorium etc.) is not localized but in the state of ions behaving like a Maxwellian gas[12,13] with strong Coulomb screening. A quantitative evaluation of this model was possible by considering the fusion reaction time U for DD depending on the distance d (in pm) between the deuterons[14]. As shown in Fig.1, the well known values for hot fusion, for muonic fusion, and for the calculated values for a D_2-molecule fit the following power law[14]

$$U = 8.139 \times 10^4 d^{34.8} \text{ sec} \qquad (3)$$

We emphasize that this power law we derived[14] differs from the usual exponential relation in nuclear physics. This relation (3) was used for evaluating the distance d for the few reversibly measured cold fusion gains of deuterated palladium in plasma environment as performed by Prelas et al and by Yamaguchi et al[14]. The result was that d = 3 pm. This furthermore implied that there is a strong screening for reducing the Coulomb potential. We found a fit of the experimental values if a Coulomb screening by a factor 14.1 is used and that for a Maxwell ion distribution of room temperature, only ions with more than 2.33 eV energy were reacting. Relating this to a deuteron gas without screening, this corresponds to an energy above 470 eV where the small number of deuteron reactions can be understood even if the reaction rate may differ from the well known hot fusion conditions, Eqs. (1) and (2). Being aware of the reaction energy of a few eV of the deuteron or protons, we postulated that a very long interaction time at the very low momentum transfer according to quantum relations (as known from uncertainty) provides different conditions[15]. The fact that only the very energetic part of the Maxwellian distribution can react, will exclude any uncontrolled explosive nuclear reaction in cold fusion or in low-energy nuclear transmutation.

The remaining question was how the Coulomb screening can have such a high value as 14. High screening for cold fusion has been discussed by Ichimaru[16] in his review comparing with high density astrophysical, pycnonuclear and other reactions, but it may be difficult to achieve such high screening inside a homogeneous metal. We concluded that the high screening occurs in the "swimming electron layers" at metal surfaces or at interfaces between metals of different Fermi energy[13]. These approximately 10^{-8} cm thick electron layers have been calculated from the electric double layer theory of plasmas[17] by extending this to the degenerate electron gas in metals. This immediately resulted in a quantum theory of surface tension in agreement with experiments[18].

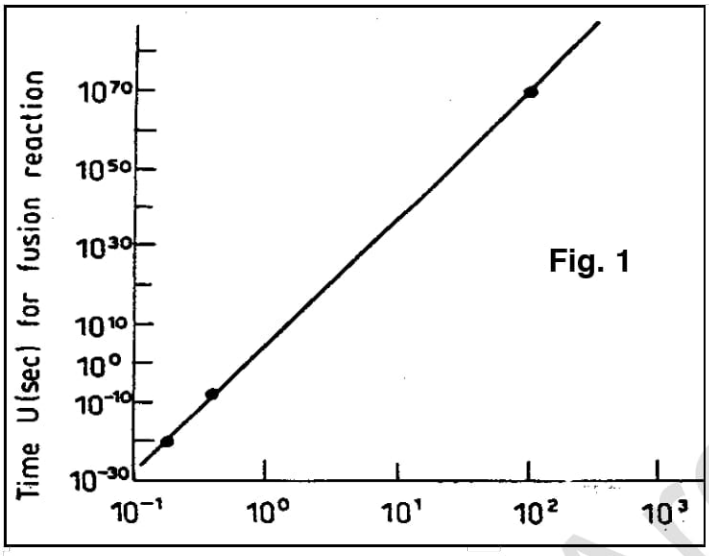

Fig. 1 Expectation value for the nuclear interaction time U between two deuterons depending on the distance in pm with experimental values for hot fusion, for muonic fusion and the calculated values for a D_2 molecule[14].

Based on these results it was important to look for cold fusion reactions at interfaces. A first result was that of Liebert et al[19] where cold fusion was reported using molten salt instead of electrolyte and where an interface between iron (as basis) and palladium was involved. We produced then multilayers with up to 20 iron-palladium interfaces. When loading these electrolytically, the heating of this multilayer appeared within several seconds where temperatures above 100°C destroyed the layers. An energy generation of kW/cm^3 was estimated inside the layers[8]. The next experiment, with nickel-palladium interfaces in Patterson cells,[9] showed a similar effect of energy production, though the deposition of the films by electron beam evaporation instead of chemical deposition resulted in less energy production. In these experiments, the Auger analysis and secondary ion mass spectrometry (SIMS) and neutron activation resulted in the discovery of nuclear transmutation reactions of the protons or deuterons with the nuclei of the host metal (nickel, or palladium, or platinum)[9,10].

3. A FURTHER CONFIRMATION FROM HELIUM PRODUCTION

In support of our result[14] that the reaction distance in the low-energy DD fusion reactions is in the range or 3 pm, we can here refer to the measurements of Arata et al[20]. In this case hermetically sealed 5g palladium black loaded with deuterium was kept for 5000 hours and — reversibly in a series of experiments — an excess heat of 5 to 20 Watts was measured at 35°C. At the end, the material was heated to 1000°C and a large amount of helium was released from the palladium as analyzed by a quadruple mass spectrometer (carefully differentiated from deuterium). The amount of about 3×10^{19} He atoms corresponded to an average power production of 7 W in fair agreement with the measured heat production.

The particles of the palladium black consisted of spheres of about 0.4 mm diameter. This corresponds to 1.6×10^{13} spheres with a surface of 8×10^4 cm^2. We can assume that the surface was under the perfect conditions of the swimming electron layers and that the reactions of the deuterons were performed there where the mean free path of the (more than 1 eV) energetic deuterons is assumed to be larger than the diameter of the spheres. Per sphere, 1.1×10^{-2} reactions/sec occurred, which results in a probability time $U = 1.5 \times 10^{11}$ s for one reaction. This probability has indeed a statistical character like radioactive decay. From Eq. (3) we arrive then at a mean distance for the reaction of 1.51 pm. Comparing this with the 3 pm distance, which we had concluded (with a high degree of inaccuracy) for the neutron generation of the DD-reaction, we now have to be aware that a ratio 2 for the distance d results in a different probability of the reaction time U of $2^{34.8} = 2.9 \times 10^{10}$ what may be related to the factor $R_{4He} = 10^{11}$ in Eq. (2).

4. THE NEW SITUATION OF LOW-ENERGY REACTIONS

The new aspect for nuclear physics opened by cold fusion is the fact that the constitution of the hydrogen or deuterium (or tritium) ions in the host metals permits them to perform nuclear reactions at exceptionally low-energy. It was estimated from basic quantum relations including the long interaction time of the hydrogen ions[15] that their energy cannot be below a minimum value of 1 to 2 eV. This was based on a description of the hydrogen ions (speaking in the same way of other hydrogen isotopes) as a non-degenerate gas. Whether this all may relate to other models as the "tight orbit" model of magnetic interaction of Vigier[21] or of phonon interaction models[22] with or without crys-

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talline localization of the ions (contrary to our assumption of a Maxwellian gas) should not be excluded. We only may not need very exotic models, which have come even from very renown institutions—relating cold fusion to the hydrodynamics of solar flares, Bose-Einstein condensation, or ball lightning.

Nuclear reactions with low-energy of the reaction partners are exceedingly well known from thermal neutron reactions. It is well known that then the interaction radius (collision parameter) can be 100 fm for uranium, though the radius of the electric charge of the nucleus is in the range of 5 fm. The situation of the Maxwellian proton (speaking also for deuteron) gas in the host metal with high electron concentration at surfaces or interfaces may permit similar low-energy nuclear reactions for the charged protons. These reactions may be between the ions (cold fusion) or with other neighboring heavier nuclei (transmutation), taking into account also some screening by lower bound electrons.

The long nuclear distances as mentioned from the thermal neutron reaction with uranium appeared also at hot DD fusion[14] when considering the central collision minimum distance for a 10keV fusion DD reaction: it is 143 fm while the electric charge of the deuterons is within a radius of about 1 fm. There are reasons to define the radius of the deuteron[23] at the much larger value of 4.3 fm. But even with this large radius, a Gamov factor with respect to the mentioned hot fusion distance is 3.6 $\times 10^{-15}$, therefore out of discussion. We may recall that the distance for a singulett scattering of a deuteron potential results in 23.3 fm, but it was shown that such bound singulett state of the proton neutron system does not exist. This may change if there is an interaction with another deuteron, especially at the very low interaction energy and during the very long interaction time of the "thermal" interaction considered here. The mentioned large impact parameter is comparable with that of 10 eV neutron scattering at deuterons, 25.4 fm, where again the spin relations (according to Wigner) have to be considered. This may refer also to the increase of hot fusion energy generation using spin polarized fuel where nonlinear conditions may result even in an increase by a factor of 5 or more[24]. It should be mentioned at this stage that the orbital electron capture is a long time, long distance nuclear interaction to be taken into account also for our discussion of the low-energy proton nuclear reactions.

Spin relations and rotational states may play an important role in the low-energy transmutation reactions[14]. Since the earlier applied detectors for gamma or neutron emission in the experiments[9] did not yet indicate energetic reaction products of this kind we may assume that the expected high reaction energy may go into numerous gamma levels of lower energy such that low-energy x-ray detectors, apart from beta and alpha detection, may have to be applied. These energies may be connected also to the anapole moments in nuclei which are due to parity-violating nuclear forces which create spin spirals and toroidal electromagnetic currents inside the nuclei. These theoretically predicted[25] properties were recently measured with high accuracy[26] — a sensational achievement. The experiments made visible the weak nuclear force effects by properties of the electron cloud of atoms. It should be mentioned that cold fusion was clearly detected by Dufour[27] from excess heat and this was related to electron weak force effects. These experiments resulted in the detection of copious emission of low energy radiation (likely to be betas) similar to the case of the transmutations discussed here,[9] where energetic gamma or neutron emission has not yet been measured with the instruments applied. This all may point to a new situation in which special states in the electron cloud of atoms or metals are involved with nuclear reactions. One should not forget that the well known capture of K-electrons (E.C.) is a long time interaction process of nuclei with the electron cloud of an atom.

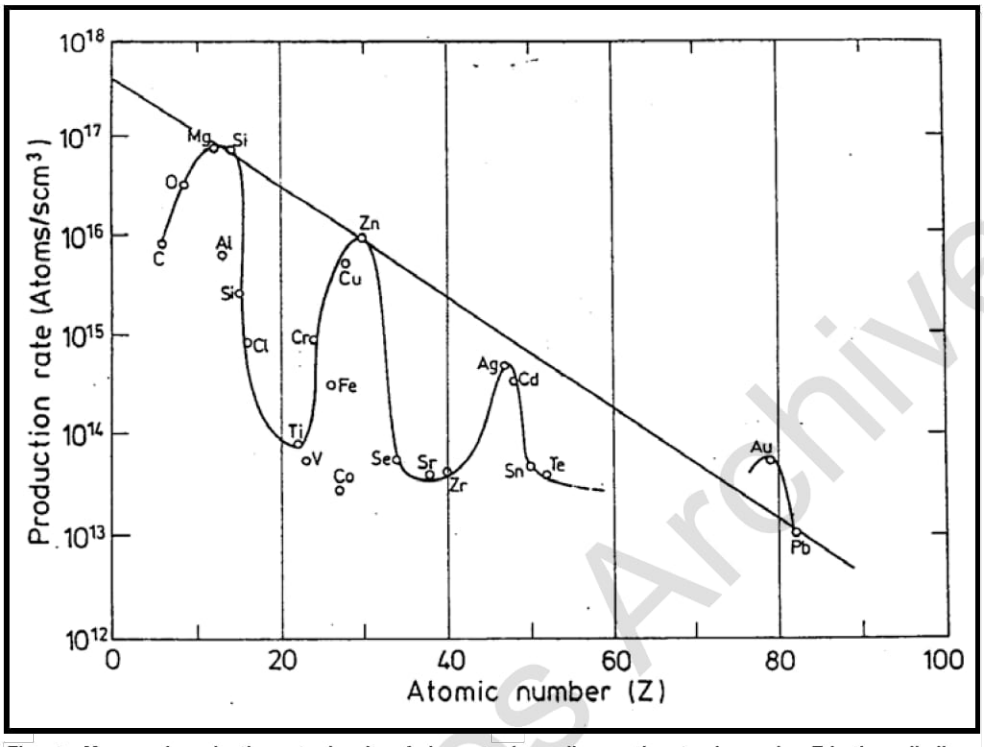

Fig. 2 Measured production rate density of elements depending on the atomic number Z in the palladium layers covering plastic spheres (beads) after being located for several hours between the electrodes electrolyzing a water solution[9]. The concentrations of the created elements were measured with secondary ion mass spectrometry (SIMS) and other methods where the beads did not show these elements before the electrolysis. The measured elements had deviations from the natural isotope concentration by up to 15% in agreement with fundamentally different experiments[10].

One other related question may the values of the Gamow-Teller matrix elements if special assumptions about the nuclear structure are possible. The "swimming electron layer model" was studied quantum mechanically and could be formulated as continuum-electron shielding[28].

The question why the transmutation (or fission) by low-energy protons does not result in radioactive nuclides may be answered by the following example taken from the earlier observed[9] possible branches:

$$Pd^{106} + p = Se^{80} + Al^{27} + 12.15\ MeV \quad (4)$$

$$Pd^{106} + p = Br^{81} + Mg^{26} + 11.31\ MeV \quad (5)$$

$$Pd^{106} + p = Br^{79} + Mg^{28} + 8.32\ MeV \quad (6)$$

Of all reaction products, only Mg^{28} is unstable (β, 21h). But obviously the generated energy is much lower than the proton low-energy fission reactions resulting in stable nuclei (4) and (5). One may imagine that the very long interaction time[15] permits the sorting out to achieve the highest energy branch, and that may lead to stable nuclei only.

5. DERIVATION OF AN EXPONENTIAL RELATION FOR LOW-ENERGY TRANSMUTATION

The experiments (repeated several times)[9] used about 1mm diameter glass

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or plastic spheres (beads) covered with about 100 nm nickel or palladium or multilayers of these metals. These beads were located in electrolytically conducting water between the electrodes performing a low power electrolysis. After a two hour loading period of the metal layers with protons, where no significant excess heat was produced, a considerable excess heat production was measured, which can be related to nuclear reactions. Using several sophisticated analyzing techniques, it was measured that e.g. a considerable amount (up to 50%) of the nickel was transmuted into iron and other elements. The resulting elements had isotope ratios which were different from the natural ratio. This could be measured simultaneously by different analyzing techniques. The transmutations occurred also in experiments without the beads, but using gold electrodes or platinum electrodes[10]. Even the time dependence of the change of the isotope shift during the few weeks duration of these experiments could be measured.

When plotting the rate N(Z) of generated atoms of an element Z per $cm^3 \cdot s$, Fig. 2, a number of maxima and minima were detected. This was the same with the very different methods of the experiments with the beads[9] as well as the usual electrodes[10]. This result has an analogy to the fast neutron induced nuclear fission of uranium or plutonium, where two maxima of a similar distribution of elements appear , where one isotope is stable and the other mostly unstable. In our case with the low-energy proton reaction, it seems that the resulting nuclei are stable, as mentioned in the preceding paragraph.

In Fig. 2, we recognize that the maxima are decaying with Z. If we use a straight line, we find the following relation for the maxima

$$N(Z) = N' \exp(-Z/Z') \qquad (7)$$

where the values of Z'= 7.86 and N'= 3.56×10^{17} atoms/$cm^3 \cdot s$ are found. This result shows that higher-Z atoms are produced less by orders of magnitudes, apart from the minima of the distribution of Fig. 2, which again are up to 1000 times less than the maxima. The result of Fig. 2 is from beads with a palladium layer. When using beads with five layers Ni-Pd-Ni-Pd-Ni, the value of Z'=9.7. Taking the results of 6 runs as shown in Fig. 2 (see Fig. of Ref.9), the result is Z'=10.638 and N'=3.91×10^{17}. At this stage it does not make sense to speculate more about the accuracy or any physical background of the rather little scattering of these values. What is interesting is that the exponential relation and that the order of magnitude of N for lower values of Z reproduces the observation that the transmutation of a considerable percentage of the atoms has occurred within days and weeks in agreement with the observations.

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6. NEW PROGRAMMED TRANSMUTATION OF ADDED NULIDES ESPECIALLY LONG-LIVED NUCLEAR WASTE AND PLUTONIUM

Based on the earlier experiments[8,9] or modifying this by alternative filling of the proton or deuterons into the host metals by plasma, gas, or liquid salt methods instead of water based electrolytes and by modifying the large surfaces of interaction from that of spherical beads to cluster particles or highly dispersed surfaces of any geometry, one can actively incorporate nuclides into the surface area of the active metals or nearby. These additional nuclides can then be subject to low-energy nuclear transmutation. This can be done with respect to stable or unstable nuclides for all purposes in medicine and technology.

One application of the mentioned transmutation is the long lived nuclear waste from nuclear fission reactors. Most of the chemical elements into which the fissioning uranium or plutonium nuclei split are - apart from stable nuclei — mostly short-lived radioactive isotopes which rather quickly decay into stable nuclei. The problems are the remaining long-lived nuclei, of which the following ones are mentioned, giving the half life in brackets:

^{99}Tc (2.13×10^5y), ^{126}Sn (1.1×10^5y), ^{129}I (1.7×10^7y), ^{135}Cs (2.3×10^6y), ^{107}Pd (6.5×10^6y), ^{93}Zr (1.5×10^6y)

A GW (electric) power station produces per year for example, 257 kg of the mentioned technetium isotope or 59.4 kg of the mentioned iodine[29].

Furthermore the generated nuclei near uranium are in most cases long-lived too. a TRU reactor of 900 MW(electric) produces per year 138 kg plutonium(239), 52.8 kg plutonium(240), 10 kg neptunium(237), 5.1 kg americium 241 or 0.7 kg curium(244) and other neighbor isotopes in smaller quantities. The proliferation problem is a very important international issue. Plutonium(239) can be processed into mixed oxide (MOX) and then used in power reactors as fuel. This is what is being done, for example Japan is buying this plutonium as an energy storage for the future. Of the 430 civilian power reactors 800 tons of plutonium is in the waste and 200 tons were reprocessed into MOX. In the weapons arsenal there are 400 tons available from the proceeding disarmament procedures[30]. Nevertheless, there seem to be good reasons for the US Department of Energy not to follow the use of plutonium as MOX for energy production, but to eliminate it by vitrification and to store this, though this potentially might allow the stored samples to be removed from their hidden places, and the chemically readily extracted plutonium might be used for weapons by questionable governments or criminal powers.

It is an important aim to make plutonium fully extinct by nuclear transmutation into chemically different nuclei, e.g. uranium where the isotopes can be blended into other uranium, from where any isotope separation is exceedingly expensive and difficult. These kind of nuclear transmutations are indeed possible by using ion beams with ions of more than 10 MeV per nucleon or spallation processes with up to 10 GeV protons. In view of the very expensive accelerators needed for this purpose, and in view that the ion currents there are rather small, there is no economic possibility in sight from this method. The invention described in this (Clean Energy Technology) patent provides a low cost technique to make plutonium extinct, as well as the nuclear transmutation of other long-lived isotopes appearing in high quantities in nuclear waste into stable isotopes.

The low-energy transmutation by protons provides a low cost method for converting the long-lived waste nuclides and the plutonium into non-radioactive or harmless nuclides. The low-energy nuclear p- or d- reactions occur at the interfaces between the layers and their support or at the layer surface against the electrolyte or the mentioned alternative environment. Volume reactions of the low-energy type are also possible. Beyond the initiating p- or d-reactions, there are secondary nuclear reactions of the nuclei of the generated isotopes with other nuclei in the materials. Significant cases of nuclear transmutation of long-lived isotopes incorporated into the surface areas of the host metals are the following

$$^{99}Tc(p,\alpha)^{96}Mo + 6.38 \text{ MeV};$$
$$^{99}Tc(d,\alpha)\ ^{97}Mo + 10.86 \text{ MeV} \qquad (8)$$

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leading to stable nuclei. Also the following reactions lead to stable transmutation products of

$^{129}I(p,\alpha)^{126}Te(+6.47MeV)$
$^{129}I(d,\alpha)^{127}Te(+10.46MeV)$
$^{135}Cs(p,\alpha)\ ^{132}Xe(+6.34MeV;$
$^{135}Cs(d,\alpha)^{133}Xe(+10.7MeV)$
$^{107}Pd(p,\alpha)^{104}Rh(+3.47MeV)$
$^{107}Pd(d,\alpha)^{105}Rh\ (+10.17MeV)$ and
$^{93}Zr(p,\alpha)^{90}Y(+4.26MeV)$.

In some cases, as for example:
$^{126}Sn(p,\alpha)^{123}In\ (+2.278MeV)$ or
$^{126}Sn(d,\alpha)^{124}In(+5.79MeV)$

result in fast beta decay products which finally transmute to the stable ^{123}Sb and ^{124}Sn respectively. The d-reaction with ^{93}Zn cannot be used since it arrives at long lived ^{91}Nb, if this is then not eliminated in the same way as described with the other long-lived isotopes.

For the extinction of the most important plutonium isotopes we have the following reactions. The following isotope with a half life of $2.4x10^4$ y reacts in the following way

$$^{239}Pu + p = {}^{236}Np + {}^{4}He + 10.13\ MeV \quad (9)$$

$$^{239}Pu + d = {}^{237}Np + {}^{4}He + 14.42\ MeV \quad (10)$$

while the following isotope with a half life of 6537 y reacts as

$$^{240}Pu + p = {}^{237}Np + {}^{4}He + 10.19\ MeV \quad (11)$$

The isotopes neptunium(236) and neptunium(237) with the half lives of $1.55x10^5$ y and $2.14x10^5$ y are considered as harmless but there is the transmutation possible in the same way by the methods of low-energy nuclear transmutation

$$^{237}Np + p = {}^{234}U + {}^{4}He + 11.67\ MeV \quad (12)$$

to reach a uranium isotope which again is harmless since this can be blended into other uranium.

In view of the large amounts of nuclear waste transmutation or the plutonium extinction to be treated by the surface process of this invention, the techniques for producing the largest possible surfaces have to be used and larger scale reaction plants are leading to a low cost solution for long-lived nuclear waste and for a low cost extinction of plutonium.

References:

1. F. Paneth, and K. Peters, *Berichte der Deutschen Chemischen Gesellschaft* 59, 2039 (1926); *Naturwissenschaften* 14, 958 (1926); F. Paneth, *Nature* 119, 728 (1927).

2. Ronald McNally, *Bull. Am. Phys. Soc.*, 28, 658 (1983); *Fusion Technology*, 7, 331 (1985).

3. S. Jones, E.P. Palmer, J.B. Czirr, D.L. Decker, G.L. Jensen, J.M. Thorne, S.F. Taylor, and J. Rafelski, *Nature* 338, 737 (1989).

4. M. Fleischmann and S. Pons, *J. Electroanal. Chem.* 261, 301 (1989).

5. D. Morrison, Discussion at the 6th Int. Conf. on Cold Fusion, Hokkaido, Oct. 1996.

6. T.N. Claytor, M.J. Schwab and D.G. Tuggle, *6th Int. Conf. on Cold Fusion, Hokkaido, Oct 1997, Book of Abstracts*, p. 53.

7. M.H. Miles and K.B. Johnson, *Progress in New Hydrogen Energy*, M. Okamoto ed., (New Energy and Industrial Technology, Tokyo 1997) p. 208.

8. G.H. Miley, E.G. Batyrbekov, H. Hora, and R.L. Zich, *Transaction of Fusion Technology* 26, 313 (1994).

9. G.H. Miley, G. Marne, M.J. Williams, J.A. Patterson, J. Nix, C. Cravens, and H. Hora, *Progress in New Hydrogen Energy,* M. Okamoto ed., (New Energy and Industrial Technology, Tokyo 1997) p. 629.

10. T. Mizuno, T. Ohmori, T. Akimoto, K. Kurokawa, M. Kataichi, K. Inoda, K. Azumi, S. Simokawa and M. Eyno, *Progress in New Hydrogen Energy*, M. Okamoto ed., (New Energy and Industrial Technology, Tokyo 1997) p. 665; T. Ohmori, T. Mizuno, and M. Enyo, *Progress in New Hydrogen Energy*, M. Okamoto ed., (New Energy and Industrial Technology, Tokyo 1997) p. 670.

11. A.G. Lipson, V.A. Kuznetsov, D.M. Sakov, and E.I. Saunin, *Progress in New Hydrogen Energy*, M. Okamoto ed., (New Energy and Industrial Technology, Tokyo 1997) p. 512.

12. H. Hora, G.H. Miley, L. Cicchitelli, A. Scharmann, and W. Scheid, *Emerging Nuclear Energy Systems* 1989, U. von Möllendorff and B. Goel Eds., (World Scientific, Singapore 1989) p.322, H. Hora, L. Cicchitelli, G.h. Miley, M. Ragheb, A.Scharmann, and W. Scheid, *Nuovo Cimento* 120, 393 (1990)

13. H. Hora, G.H. Miley, M. Ragheb, and A. Scharmann, Cold Fusion, *World Hydrogen Energy Conference* #8 July 1990 Hawaii, Special Symposium Proceedings (Hawaii Natural Energy Institute, Univ. Hawaii 1990) p. 169.

14. H. Hora, J.C. Kelly, J.U. Patel, M.A. Prelas, G.H. Miley, and J.W. Tompkins, *Phys. Lett. A*175, 138 (1993).

15. H. Hora, G.H. Miley and J.C. Kelly, Progress in New Hydrogen Energy, M. Okamoto ed., (New Energy and Industrial Technology, Tokyo 1997) p. 529

16. S. Ichimaru, *Rev. Mod. Phys.* 65, 255 (1994).

17. S. Eliezer and H. Hora, *Phys. Report* 172, 339 (1989).

18. H. Hora, Gu Min, S. Eliezer, P. Lalousis, R.S. Pease, and H. Szichman. *IEEE Trans. Plasma Sci.* PS-17, 290 (1989).

19. B.Y. Liaw, P.L. Tao, P. Turner and B.E. Liebert, *J. Electroanal. Chem.* 319, 161 (1991).

20J. Arata and Y.-C. Zhang, *Progress in New Hydrogen Energy*, M. Okamoto ed., (New Energy and Industrial Technology, Tokyo 1997) p. 129, Y. Arata, and Y.-C. Zhang, *Proceedings of the Japan Academy, Series B Physical and Biol. Sci.*, B73, 1 (1997).

21. J.P. Vigier, *Phys. Letters A*221, 138 (1996).

22. J. Schwinger, *Zeitschr. Phys.* D15, 221 (1990): P.L. Hagelstein, *Progress in New Hydrogen Energy,* M. Okamoto ed., (New Energy and Industrial Technology, Tokyo 1997) p. 382.

23. T. Meyer-Kuckuck, *Kernphysik,* (Teubner, Stuttgart 1984).

24. L. Cicchitelli, J.S. Elijah, S. Eliezer, A.K. Ghatak, M.P: Goldsworthy, H. Hora, and P. Lalousis, *Laser and Particle Beams* 2, 467 (1984).

25. V. V. Flambaum, I.B. Khriplovich, and O.P. Sushkov, *Phys. Letters B*146, 367 (1984).

26. C. Wieman et al, *Science*, 21 March 1997

27. J. Dufour, *Fusion Technology* 24, 205 (1993)

28. Y.E. Kim and A.L. Zubarev, *Progress in New Hydrogen Energy*, M. Okamoto ed., (New Energy and Industrial Technology, Tokyo 1997) p. 265

29. Jean Tommasi et al, *Nucl. Technol.* 111, 133 (1995)

30. Philipp Campbell, Editorial, *Nature* 384, 599 (1996)

(L-R) Dr. Hora, Dr. Patterson, CETI CEO James Reding, and Prof. George Miley at ICCF-6 *(Courtesy, Gene Mallove)*

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Well-Documented Arata-Zhang Work Appears to Confirm Massive Helium-3 and 4 and Energy Production in Cold Fusion

Infinite Energy received news of this breakthrough development in Cold Fusion from a representative of Dr. Arata, including the 56 page— **Special Issue** of the journal of the Japan High-Temperature Society, dedicated *entirely* to the Arata-Zhang work. Two papers in the *Proceedings of the Japan Academy of Science* immediately preceded the Special Issue.

Dr. Talbot Chubb, formerly with the US Naval Research Laboratory and now with Oakton International Corporation* kindly provided us with the following excellent commentary on the Arata-Zhang work. (We reprint the abstracts of the original papers following the commentary.)—*EFM*

(*2714 Clarkes Landing Dr., Oakton, Virginia 22124, TEL: (703) 620-5886, VOICE MAIL: (703) 790-2346, FAX: (703) 620-6247, E.MAIL: oicresmith~aol.com)

Research Summary: Arata and Zhang Discovery of ^{3}He Cold Fusion Reaction Product

by Dr. Talbot Chubb

Drs. Yoshiaki Arata and Yue-Chang Zhang are senior scientists who work at Osaka University in Japan. The latest Arata and Zhang paper announces their discovery of ^{3}He in gases desorbed from palladium black electrode material that had previously produced heat. The observed ^{3}He/^{4}He ratio is about 0.1 compared with a ratio of 0.00013 observed in helium derived from air. The same palladium powder that had not previously produced heat shows no helium of either isotope. The data confirm that a nuclear reaction had previously occurred in the palladium and therefore that Fleischmann-Pons type cold fusion is real. In combination with theory the data identify 2 nuclear processes which produce heat without radiation.

The mass spectrometer studies that provided these results are described in the accompanying paper. Small portions of palladium test powder were evacuated and then heated to temperatures above 1200°C in a sealed vacuum chamber. The desorbed gases were analyzed by 2 high resolution mass spectrometers which repetitively scanned the mass-3 and mass-4 peaks. The gases were analyzed when first introduced into the mass spectrometers and during the subsequent period when the action of a getter pump gradually removed hydrogen from the system. The pressure in the vacuum system before the gases were introduced was 3 x 10^{-9} Torr. The key data are those shown in the bottom right corner of (their) Fig. 2. These data show a repeated double peak structure during scans across the mass-3 position. This behavior was observed after 1.1 hour of getter pump action. The double peaks are due to HD^+ and $^3He^+$ ions, both of which are nominally mass-3. The data in the bottom left corner is corresponding mass-4 data for the same time period. The data show only the 4He+ peak. Different samples of Pd powder have shown ^{3}He/^{4}He ratios in the range 0.1-0.25. Since the spectrometer system had never been exposed to ^{3}He gas, the anomalous ratio found is a for-sure indicator that a nuclear reaction had previously occurred in the Pd powder.

Drs. Arata and Zhang work in a medium size laboratory room on the technical campus of Osaka University. They have great skill, dedication, carefulness, and integrity. Dr. Arata is a member of the Japan Academy and is recognized by a building on the technical campus named in his honor. He is also a recipient of the Arthur Schawlow Award. Previous to these studies Drs. Arata and Zhang seem to have solved the cold fusion heat reproducibility problem, having run with their present techniques 6 successful excess heat runs out of 6 tries, with some runs having integrated heat outputs exceeding 30 kWH.

The above results should be compared to Dr. Al Nier's 1940 measurements that showed that ^{235}U is the fissionable isotope of uranium.

***Proc. Japan Acad.*, 72, Ser. B (1996)**

Deuterium Nuclear Reaction Process within Solid

By Yoshiaki ARATA, M.J. A., and Yue-Chang ZHANG
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(Communicated Nov. 12, 1996)

Abstract: In a series of studies, a significantly large amount of helium (^{4}He/D_2~(1~0.2) x 10^{-2} and ^{4}He/^{3}He≈4, D_2: "fuel" helium: "ash") was clearly detected with a quadrupole mass spectrometer (QMS) as the deuterium nuclear reaction product ("ash") released from the highly deuterated palladium host-solid (Pd-black distributed 0.02~0.06 [μ]: average 0.04 [μ]) that had produced large amounts of anomalous excess energy (200~500 [MJ/cm^3]) through long period such as 5000 [hrs], when it was heated in a high vacuum (≈10^{-8} [torr]), high temperature (≥1000 [°C]). On the other hand, a simultaneous measurement by another QMS caught a signal of the existence of ^{3}He, while it is considerably less [in] existence than ^{4}He. In comparable measurements from non-deuterated samples, any helium and deuterium were not detected. This means that there exist no well-known Rutherford type as a main reaction of the deuterium nuclear reaction within Pd host-solid, and an inherent feature of solid-state with much valency electron cloud such as Pd presents a circumstance for a new type of deuterium nuclear fusion reaction which directly produces ^{4}He as main reaction product. Because the helium (^{4}He, ^{3}He) was observed only after each sample had been heated in a high vacuum, in each case, the laws of physics require that this helium could not have diffused from any outside source other than the Pd metal sample. Also because helium was observed only after the sample was heated to a relatively high temperature, in each case, it must have been trapped within an interior location of the sample. Because there is no known process that can account for the diffusion of the large amounts of helium into the interior locations of the various samples at the levels that were measured, the only possible explanation for the helium being trapped in this fashion is that it was trapped within each sample after it was first produced as the nuclear ash from an electrolytically induced (Cold Fusion) deuterium nuclear reaction. To understand these results, the authors have constructed a theory, based upon a coherent process that is believed to be induced in highly deuterated Pd black crystals. In this theory, it is postulated that Cold Fusion is initiated through the formation of a Strongly Coupled Plasma ("SC-Plasma"), reminiscent of the SC-plasma's that are found within stellar interiors. This postulate is consistent with the assumption that a deuterium nuclear reaction is initiated in a localized zone within a host solid, and it is indispensable that the deuterium be transformed coherently for at least a few picoseconds into a SC-plasma, which the authors refer to as a deuterium "coherent plasma" within the solid-state. It is also postulated that this "coherent solid-state plasma fusion" is initiated through a violent, localized vibration of the lattice, which the authors refer to as a "Latticequake." This "Latticequake" is essentially accompanied with both of an intense electromagnetic turbulence and violently shaking electron cloud under a many body effect in coherent-state.

Key words: *Solid-state plasma theory; cold fusion; helium; closed QMS; coupled spectrum.*

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Proc. Japan Acad., 73, Ser. B (1997)

Helium (^{4}He, ^{3}He) within Deuterated Pd-black

By Yoshiaki ARATA, M.J. A., and Yue-Chang ZHANG
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(Communicated Jan. 13, 1997)

Abstract: Authors have clearly proven for the first time that deuterium nuclear reaction was continuously generated inside a highly deuterated solid by showing both of the excess energy and corresponding amount of helium as the reaction product generated simultaneously. Whenever there is a nuclear fusion reaction inside a metal, helium generated is unable to escape to the surroundings and is trapped in a frozen state inside that metal. The concentration of the helium within the metal will rise with increasing rate of reactions. Pd-black is under such state as the sample used and sealed within the "closed QMS" developed by the authors (closed vessel including the Getter pump and the QMS). It is completely separated from the surroundings and the internal gases are removed to create super-vacuum. The reaction product released by the "Sample-Heating" process (room temp.↔1500 [°C]) is thus the only matter which occupies the interior of the closed vessel and its detection by the QMS is assured. When the "closed QMS" works under the above mentioned-state, it was clarified that the "ash" or the reaction product of this fusion reaction within a solid is ^{4}He and ^{3}He and their ratio is ^{4}He / ^{3}He~4. It can be concluded from the result that the main reaction product is ^{4}He and it is created directly as an inherent feature of the solid-state nuclear fusion. Authors think that the reaction process responsible for the creation of ^{3}He may be a different one from that creates ^{4}He. One of which is the Rutherford reaction process and the other occurs based on the specific properties of solid, similar to the case of ^{4}He. The existence of ^{3}T will be required that the process is responsible for the generation of ^{3}He as the Rutherford reaction. The proof for the existence of ^{3}T within the "closed QMS", however, was not obtained in this experiments.

Key words: *Helium (4He, 3He); cold fusion; Pd-black; closed QMS; coupled spectrum.*

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Solid-State Plasma Fusion ("Cold Fusion")

YOSHIAKI ARATA and YUE-CHANG ZHANG
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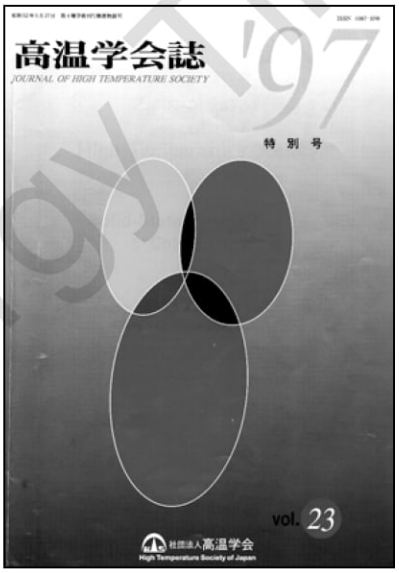
Abstract: Using a quadrupole mass spectrometer ("QMS"), significantly large amounts of helium (^{4}He/D_2 ≈ (1~0.2)x 10^{-2}, and ^{4}He/^{3}He≈4, D_2: fuel, ^{4}He, ^{3}He: ash) were detected from deuterated palladium samples that had produced large amounts of anomalous excess energy (200-500 MJ/cm^3) during Cold Fusion experiments (≈5000 [hr]). The helium was released from samples after the observation of excess energy, and only when each sample was heated to a high temperature (≥1000°C) in a high vacuum (~3 x10^{-9}[Torr).

On the other hand, a simultaneous measurement by another QMS caught a signal of the existence of ^{3}He, while ^{4}He outnumbers ^{3}He. In comparable measurements from non-deuterated samples, any helium and deuterium were not detected. This means that there exist no Rutherford type as a main reaction of the deuterium nuclear reaction within Pd host-solid, and an inherent feature of solid-state with much valency electron cloud such as Pd presents a circumstance for a new type of deuterium nuclear fusion reaction which directly produces ^{4}He as main reaction product.

Because, the helium (^{4}He, ^{3}He) was observed only after each sample had been heated in a vacuum, in each case, the laws of physics require that this helium could not have diffused from any outside source other than the Pd metal sample. Also because helium was observed only after the sample was heated to a relatively high temperature, in each case, it must have been trapped within an interior location of the sample. Because there is no known process that can account for the diffusion of the large amounts of helium into the interior locations of the various samples at the levels that were measured, the only possible explanation for the helium being trapped in this fashion is that it was trapped within each sample after it was first produced as the nuclear "ash" from an electrolytically induced (Cold Fusion) deuterium nuclear reaction.

The characteristic dimension (~ 0.04[μ]:distributed 0.02~0.06[μ]) of the Pd-black crystals where D-loading occurs in the Double Structure (DS) Cathodes (that were used to obtain these results) is significantly different from the comparable dimension of the Pd crystals that are present in electrodes that are commonly used in other heavy water, electrolytic, Cold Fusion experiments. Because the authors have successfully employed DS-Cathodes to obtain large amounts of excess heat, reproducibly, over a four year period, it is possible that this difference in characteristic dimension may be playing an important role in the initiation of anomalous Cold Fusion excess energy.

To understand these results, the authors have constructed a theory, based upon a coherent process that is believed to be induced in highly deuterated Pd black crystals. In this theory, it is postulated that Cold Fusion is initiated through the formation of a Strongly Coupled Plasma ("SC-Plasma"), reminiscent of the SC-plasma's that are found within stellar interiors. This postulate is consistent with the assumption that a deuterium nuclear reaction is initiated in a extremely localized zone (such as "Atom Cluster" with 1~10^5[unit lattice]) within a host solid, and it is indispensable that the deuterium be transformed coherently for at least a few picoseconds into an SC-plasma, which the authors refer to as a deuterium "coherent plasma" within the localized zone with an Ultrahigh Energy Density ("UHED" zone) of solid-state. To describe the reaction which occurs the authors use the term "solid-state plasma fusion" ("Cold Fusion"), which is a "coherent solid-state plasma fusion" in substance. It is also postulated that this "coherent solid-state plasma fusion" is initiated through a violent, localized vibration of the lattice, which the authors refer to as a "latticequake". This "Latticequake" is essentially accompanied with both of an intense electromagnetic turbulence and violently shaking electron cloud under a many body effect in coherent-state. The "Latticequake" terminology mimics the terminology of naturally occurring earthquakes that occur in localized zones within the earth. The authors further suggest that lattice defects from "radiation damage" are caused by "Latticequakes" and are analogous to the "disaster zones" that remain after intense earthquakes. Such "post-quake wreckage" or lattice defects themselves, however, do not contribute directly to the fusion reaction, and it is initiated only during the intense coherent-shaking of a "Latticequake."



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New Energy Times 1997

Drs. Patterson and Cravens Awarded New Patent for Excess Energy Electrolytic Cell— U.S. # 5,607,563 —Evidence for 100-to-1 Power Ratio

SYSTEM FOR ELECTROLYSIS
Patent Number 5,607,563
Date of Patent: March 4, 1997

Inventors: James A. Patterson, 2074 20th St., Sarasota Fla 34234; Dennis Cravens, 382 Highway 244, Cloudcroft, N.M.88317

Appl. No.: 566,547
Filed: Dec. 4, 1995
Int. Cl.[6].....C25B 9/00; C25B 11/02; C25B 11/04

U.S. Cl.....204/269; 204/275; 204/284; 204/290 R; 204/290 F
Field of Search 204/275, 273, 204/222, 284, 269

References Cited

U.S. PATENT DOCUMENTS

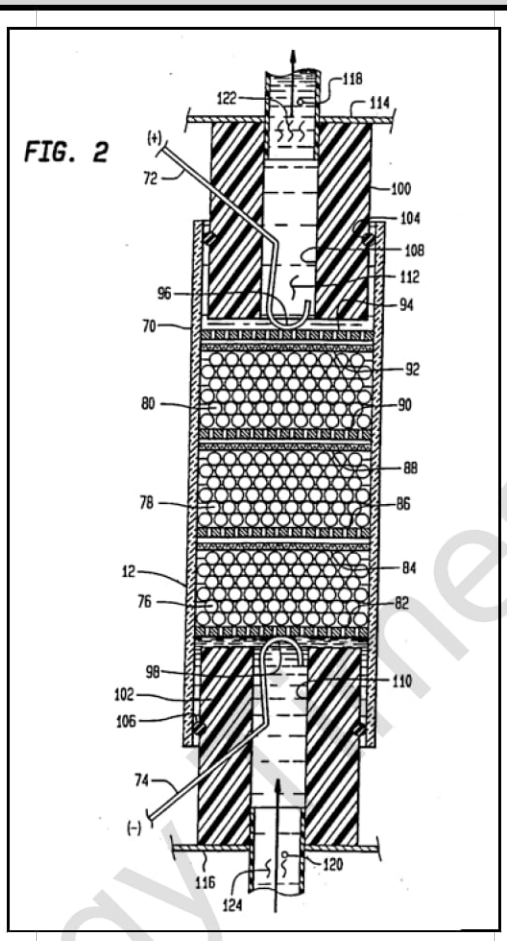
3,632,496 1/1972 Patterson.
3,888,756 6/1975 Teshima er al.
4,269,689 5/1981 Agladze.
4,316,786 2/1982 Yu et al.
4,913,779 4/1990 Lacoste.
4,943,355 7/1990 Patterson.
5,036,031 7/1991 Patterson.
5,318,675 6/1994 Patterson.
5,372,688 12/1994Patterson.

Primary Examiner—Donald R. Valentine
Attorney, Agent, or Firm—Charles J. Prescott

ABSTRACT

An electrolytic cell and system for electrolysizing and/or heating a liquid electrolyte containing water having a conductive salt in solution flowing through the cell. The electrolytic cell includes a non-conductive housing having an inlet and an outlet and spaced apart first and second conductive foraminous grids connected within the housing. A plurality of spaced beds of closely packed conductive microspheres are positioned end to end within the housing in electrical contact with the first grid adjacent the inlet. The individual microsphere beds are electrically isolated from one another in the absence of the liquid electrolyte. The microspheres are generally uniform in size and density and include a plated layer formed of metallic hydride which is readily combinable with hydrogen or an isotope of hydrogen with hydrazine to form a conductive, preferably flash coated metal layer. An electric power source in the system is operably connected across the first and second grids whereby electrical current flows between the grids within the liquid electrolyte.

16 Claims, 2 Drawing Sheets



SYSTEM FOR ELECTROLYSIS

BACKGROUND OF THE INVENTION

1. Scope of Invention

This invention generally relates to electrolytic cells, and more particularly to an improved electrolytic cell for electrolysis of water and the production of useful amounts of heat.

2. Prior Art

The present invention utilizes and improves upon microspheres formed of non-metallic beads which are plated with a uniformly thick coating of palladium. These palladium coated microspheres are taught in my previous U.S. Pat. Nos. 4,943,355 ('355) and 5,036,031 ('031). In these above recited previous patents, cross linked polymer microspheres having a plating of palladium are taught to exhibit improvements in the absorption of hydrogen and isotopes of hydrogen. Utilizing these catalytic microspheres led to my later U.S. Pat. Nos.5,318,675 ('675) and 5,372,688 ('688) (incorporated herein by reference) which teach an electrolytic cell and system for, inter alia, producing heat

The use of a palladium sheet to form one electrode within an electrolytic cell to produce excess heat, the electrolytic cell being a Pons-Fleischmann-type is taught by Edmund Storms. The description of the Storms electrolytic cell and his experimental performance results are described in an article entitled *Measurements of Excess Heat from a Pons-Fleischmann-Type Electrolytic Cell Using Palladium Sheet* appearing in Fusion Technology, Volume 3, March 1993. In a previous article, Storms reviewed experimental observations about electrolytic cells for producing heat in an article entitled "Review of Experimental Observations About the Cold Fusion Effect" FUSION TECHNOLOGY, Vol. 20, December 1991.

None of the previously reported experimental results or other prior art devices known to applicant other than my U.S. '675 and '688 patents have utilized or disclosed nonconductive copolymeric beads of palladium coated (or any substitute metal which will form "metallic hydrides" in the presence of hydrogen) conductive microspheres within an electrolytic cell for the production of heat and the electrolysis of water into its hydrogen and oxygen components. The present invention discloses the use of the '355 and '031 microspheres and various improved embodiments of preferably palladium/nickel coated microspheres within an improved electrolytic cell in conjunction with an electrolytic media containing either water or heavy water, particularly deuterium. These improved microspheres are the subject of my co-pending U.S. application entitled 'improved Uniformly Plated Microsphere Catalyst, Ser. No. 08/462,005, filed Jun. 5, 1995 ("co-pending U.S. application"). The improved electrolytic cell utilizes a plurality of subcells within one housing arranged in series to each subcell contributes to increased efficiency of the next-in-line subcell.

BRIEF SUMMARY OF THE INVENTION

An electrolytic cell and system for electrolysizing and/or heating a liquid electrolyte containing water having a conductive salt in solution flowing through the cell. The electrolytic cell includes a non-conductive housing having an inlet and an outlet and spaced apart first and second conductive foraminous grids connected within

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the housing. A plurality of spaced beds of closely packed conductive microspheres which form individual subcells in series are positioned end to end within the housing in electrical contact with the first grid adjacent the inlet. The individual microsphere beds are electrically isolated from one another in the absence of the liquid electrolyte. The microspheres are generally uniform in size and density and include a plated layer formed of metallic hydride which is readily combinable with hydrogen or an isotope of hydrogen with hydrazine to form a conductive, preferably flash coated metal layer. An electric power source in the system is operably connected across the first and second grids whereby electrical current flows between the grids within the liquid electrolyte.

It is therefore an object of this invention to utilize any one of the preferably palladium coated microspheres such as previously disclosed in my '675 and '688 patents and the multi-layer arrangement of my referenced co-pending U.S. application Ser. No. 08/462,005 in conjunction with an improved multi-bed bed electrolytic cell, for the production of either hydrogen and oxygen and/or heat.

It is yet another object of this invention to provide an improved electrolytic cell for the increased production of heat in the form of heated water or heavy water-based electrolyte exiting the cell after being heated therein.

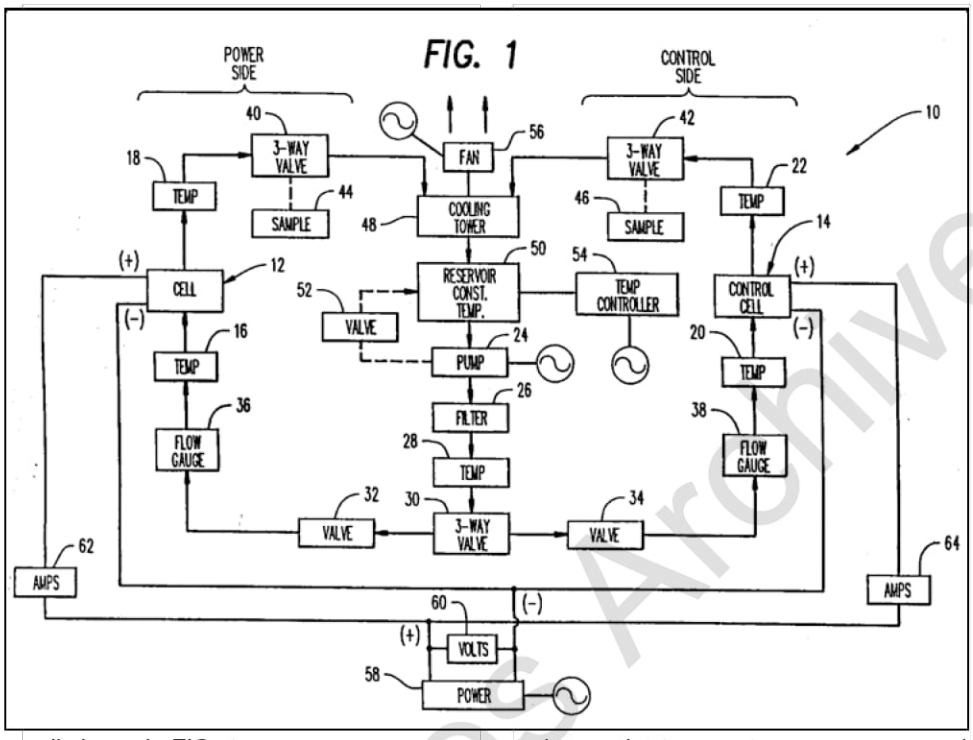
It is yet another object of this invention to utilize metal coated conductive microspheres in an improved electrolytic cell, the metal chosen from those which exhibit strong hydrogen absorption properties to form "metallic hydrides" and structurally supported by one or more adjacent uniform support plates.

In accordance with these and other objects which will become apparent hereinafter, the instant invention will now be described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of an experimental system embodying the present invention operating simultaneously in parallel with a control system for comparison.

FIG. 2 is a section view of the electrolytic cell shown in FIG. 1.



DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, an experimental or test system embodying the concepts of the present invention which was utilized during testing procedures is shown generally at numeral 10 and includes an electrolytic cell shown generally at numeral 12 described in detail herebelow. The experimental system 10 is generally comprised of a power side including electrolytic cell 12 and a control side including a control cell shown generally at 14. This control cell 14 is identical in structure with respect to electrolytic cell 12 described herebelow, except that the conductive beads utilized in the control cell are formed from solid spherically shaped tin shot of about twenty to forty mesh in diameter.

This experimental system 10 is closed loop in circulation wherein an electrolyte 112 in FIG. 2 is pumped from a reservoir 50 by pump 24 through filter 26 to a three-way valve 30, from which the electrolyte 112 then flows through open valves 32 and 34 and through flow gauges 36 and 38 respectively. The liquid electrolyte temperature is measured at 28 flowing from the reservoir 50 and also measured at 16 as the electrolyte enters electrolytic cell 12 and at 20 as the liquid electrolyte enters the control cell 14.

After the electrolytic cell 12 and the control cell 14 are completely filled with the liquid electrolyte 112, the fluid then begins to exit from each cell through the corresponding outlet tube and into three-way valves 40 and 42, respectively. Liquid electrolyte outlet temperatures are measured at 18 and 22 with respect to the electrolytic cell 12 and the control cell 14, respectively. Electrolyte samples may be withdrawn at 44 and 46 as desired to confirm composition.

The steady state flowing liquid electrolyte 112 is returned to the reservoir 50 via a cooling tower 48 from each of the three-way valves 40 and 42. A cooling fan 56 positioned above the cooling tower removes excess heat upwardly in the direction of the arrows from the fan 56.

A source of d.c. power 58, whose output voltage is monitored at 60 provides electrical power to both the electrolytic cell 12 and the control cell 14. Both the output voltage at 60 and current flow at 62 and 64 are carefully monitored so as to ensure that both the power side and the control side of this experimental system 10 are maintained identical. Likewise, flow gauges 36 and 38 serve to ensure that electrolytic flow into each of the cells 12 and 14 are identical one to another. A bypass valve 52 serves as an auxiliary means for total volumetric flow control of the liquid electrolyte from pump 24.

In FIG. 2, the details of the electrolytic cell 12 utilized during testing procedures is there shown. Again, the structure of control cell 14 is identical to that of electrolytic cell 12 except for the microsphere makeup. A cylindrical LUCITE non-conductive housing 70, open at each end, includes moveable non-conductive end members or stoppers 100 and 102 at each end thereof. These end members 100 and 102 are sealed within the housing 70 by O-rings or TEFLON tape 104 and 106. The relative spacing between these end members 100

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and 102 is controlled by the forceful movement of end plates 114 and 116 thereagainst.

These end members 100 and 102 also include a fluid chamber 108 and 110, respectively, within which are mounted electrodes 72 and 74, respectively, which extend from these chambers 108 and 110 to the exterior of the electrolytic cell 12 for interconnection to the d.c. power supply 58 in FIG. 1 having its negative and positive terminals connected as shown. This d.c. power supply 58 is preferably a constant current or voltage type. Positioned within inlet and outlet tubes are thermocouples 120 and 118 for monitoring the electrolyte temperature at these points of inlet and outlet of the electrolytic cell 12. In-line static mixers 122 and 124 are positioned in the electrolyte flow just upstream of thermocouples 118 and 120, respectively, to insure sensing of true average temperature of the electrolyte at those outlet and inlet points.

The curved end of electrode 74 is in electrical contact at 98 with a conductive foraminous grid 82 preferably formed of platinum or nickel positioned transversely across the housing 70 adjacent end member 102 while the curved end of electrode 16 is in electrical contact at 96 with another conductive foraminous grid 94 similarly formed and positioned adjacent end member 100 as shown. By this arrangement, when there is no electrolyte within the electrolytic cell 12, no current will flow between the electrodes 72 and 74.

A plurality of beds of closely packed conductive microspheres 76, 78 and 80 are positioned end-to-end or in stacked arrangements within housing 70. One end of microsphere bed 76 being positioned immediately adjacent and against conductive grid 82. These individual conductive microspheres of each bed 76, 78 and 80 are formed of a non-conductive inner polymer beads and include a uniform palladium plating layer. The preferred size of these conductive microspheres are in the range of 1.0 mm or less in diameter and the details of the manufacture of these conductive microspheres are generally taught in my previous U.S. Pat. Nos. 4,943,355 and 5,036,031. My co-pending U.S. application Ser. No. 08/462,005, filed on Jun. 5, 1995, entitled "Uniformly Plated Microsphere Catalyst", incorporated herein by reference, discloses the broad details of various improved embodiments of these conductive microspheres. These improved conductive microspheres preferably include an inner nickel plate atop a metallic flash coat, a preferably palladium plate atop the inner nickel plate, and a support plate atop the palladium, preferably nickel.

In the previously reported testing in U.S. '675 and '688, an intermediate layer of nickel was alternately added over a copper flash coat beneath the palladium plate. The nickel intermediate layer, producing a mean microsphere density of 1.51 g/cm^3, was positioned immediately beneath the palladium plated layer to increase the density of the conducive microspheres. In this testing, a black residue developed within the liquid electrolyte which was subsequently analyzed and determined to be palladium. Further investigation showed that the outer palladium coat of these previous original microspheres, being subjected to both a heat and electrical current duty cycle, either flaked, spalled and/or incurred minor cracking of the palladium plate. This inservice deterioration both shortened the useful life of the previously described cell and its efficiency in producing heat

Still referring to FIG. 2, a non-conducive foraminous nylon screens or mesh 84, 88 and 92 are each positioned against one end of each bed 76, 78 and 80 of these conductive microspheres so as to retain them in the position shown and to electrically and physically isolate the individual beds or subcells 76, 78 and 80 one from another absent the presence of the liquid electrolyte 112. Against the other end surface of each bed 76, 78 and 80 is positioned in contact with the corresponding conductive foraminous grid 82, 86 and 90 positioned transversly across the housing 70 as shown.

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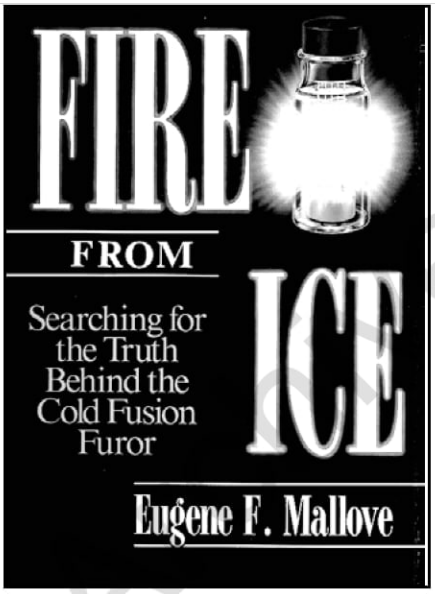

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TABLE I

Cell	DATA					CALCULATIONS			
	Electrolyte Flow Rate (ml per min)	Inlet Temp (T in)	Outlet Temp (T out)	Voltage (V)	Current (Amps)	Δ T (T out – T in)	Watts In (W in)	Watts Out (W out)	% Yield (W out – W in)
Control Cell (14)	640	35.2° C.	34.9° C.	5.0	0.49	(–)0.3° C.	2.45	(–)13.4	Heat Loss
Electrolytic Cell (12)	640	35.4°	40.8° C.	5.0	0.48	+5.4° C.	2.40	241.9	10,079%

ELECTROLYTE

When the electrolytic cell 12 is filled with a liquid electrolyte 112, current will flow from the power supply 58 between the electrodes 74 and 72 and between identical electrodes within the control cell 14. The preferred formulation for this electrolyte 112 is generally that of a conductive salt in solution with water. The preferred embodiment of water is that of either light water ($H_2{}^1O$) or heavy water and more specifically that of deuterium ($H_2{}^2O$) and their mixtures. The water ($H_2{}^10$) and the deuterium ($H_2{}^2O$) is preferred to have a minimum resistance of one megohm with a turbidity of less than 0.2 n.t.u. This turbidity is controlled by ultra membrane filtration. The preferred salt solution is lithium sulfate (Li_2SO_4) in a 1-molar mixture with water and is of chemically pure quality. In general, although a lithium sulfate is preferred, other conductive salts chosen from the group supplying ions of boron, aluminum, potassium, gallium, and thallium, as well as lithium, may be utilized. The preferred pH or acidity of the electrolyte is 9.0.

CONDUCTIVE BEADS

Palladium coated microspheres were originally preferred as disclosed in U.S. Patents '675 and '688. However, palladium may be substituted by other transition metals, rare earths and also uranium. In general, any of these metals which are capable of combining with high volumes of hydrogen to form "metallic hydrides" are acceptable. These metals known to applicant which will serve as a substitute for palladium are lanthanum, praseodymium, cerium, titanium, zirconium, vanadium, tantalum, uranium, hafnium, thorium and their alloys. Authority for the inclusion of these elements within this group is found in a book entitled "Inorganic Hydrides," by B. L. Shaw, published by Pergammon Press, 1967. However, palladium is the best known and most widely studied metallic hydride and was utilized in my previously referenced patents to form conductive hydrogen-absorbing microspheres. In an even more general sense, the broad requirement here is to provide a "metallic hydride" surface, the makeup of the core of the microspheres being a secondary consideration.

The specific composition of the conductive electrolyte beads utilized in the electrolytic cell and experiment reported herebelow is as follows:

Core: 0.9±0.1 mm diameter cross linked styrene divinyl benzene polymer sphere
1st layer copper flash 50-200 A° thick
2nd layer: base nickel layer—electroless deposited 0.5-2.0 mm. thick
3rd layer: palladium layer—electroless deposited 0.7-1.6 mm thick
4th layer: outer nickel layer—electroless deposited 0.3-0.8 mm thick

CELL RESISTANCE

In preparing the electrolytic cells for testing, the cell resistance utilizing a volt ohm meter was utilized prior to the introduction of the electrolyte into the electrolytic cell. This cell resistance, when dry, should be infinitely high. Otherwise, a short between the anode screen and the cathode beads exists and the unit would have to be repacked. Prior to testing, with electrolyte present, the cell resistance was set below 100 ohms by appropriate compression of the end members.

EXPERIMENTAL RESULTS

Utilizing the experimental arrangement described with respect to FIG. 1 and incorporating therein the electrolytic cell 12 detailed in FIG. 2, the testing procedure was single stage wherein parameters of liquid electrolyte flow and input voltage and current were carefully monitored and controlled while the liquid electrolyte temperatures were monitored carefully at the inlets and outlets of each of the cells 12 and 14. The data described herebelow in Table I was taken after approximately two hours of steady state or constant operating conditions of the system and each cell 12 and 14.

Described in Table I are data related to each of the cells 12 and 14 in the form of electrolytic flow rate in milliliters (ml) per minute (min.), electrolyte inlet temperature (T in), liquid electrolyte outlet temperature (T out), voltage (V) across each of the cells 12 and 14, and electrical current flow (amps) across each cell 12 and 14.

This above data was processed to determine the temperature range (ΔT°C.) across each cell 12 and 14 in steady state conditions. Additionally, the wattage input (W in) for each cell was calculated as the product of voltage x amps across each cell 12 and 14. The output wattage (W out) was calculated as the product of electrolyte flow rate kilograms (kg) per minute x ΔT°C.x70. The percent (%) yield was calculated by dividing the output wattage (W out) by the input (W in)x100%.

Utilizing the above data and direct calculations described hereinabove, the uncorrected yield with respect to the electrolytic cell 12 was 10,079% or, viewed another way, the output wattage (W out) was approximately one hundred (100) times that of the input wattage (W in). The calculated yield with respect to the control cell 14 represented a net loss during the identical running conditions between the two cells12 and 14.

CORRECTION FACTORS

HEAT LOSS CORRECTION

By designing the experimental system 10 in tandem or parallel with respect to the electrolytic cell 12 and the control cell 14, an excellent opportunity to establish a heat loss correction factor was provided. On the assumption that the control cell 14 produced no electrolysis and heating of the liquid electrolyte 112 did not occur within the control side and the control cell 14 of the experimental system 10, the temperature drop across the control cell 14 of 0.3° C. being viewed as radiant heat loss occurring from the liquid electrolyte flowing into this control cell at an inlet temperature of 35.2° C. Taking the ratio of [T in+T out] with respect to the control cell 14, and multiplying this as a heat loss correction factor equaling 1.0086 by the outlet temperature of the liquid electrolyte of the electrolytic cell 12 (40.8° C.), a corrected liquid electrolyte outlet temperature for the electrolytic cell 12 would be 41.2° C.

Using this corrected electrolyte outlet temperature (T out) of 41.2° C for the electrolytic cell 12 provides the revised or corrected ΔT of the electrolyte of 5.8° C. for the electrolytic cell 12. Revising the wattage output calculation as above described utilizing this corrected ΔT° of 5.8° C. instead of 5.4° C. provides a corrected wattage output of 260 watts (W out). The revised yield using this temperature correction factor would be the ratio of 260 watts (W out) / 2.4 watts (W in) x 100%=10,833% yield.

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ELECTROLYSIS CORRECTION

With respect to the electrolytic cell 12, electrolysis is occurring wherein the electrolyte 112 is being reduced into H_2 and O_2. It is well known that approximately 1.5 volts d.c. is required to accomplish this in a liquid electrolyte. Therefore, the net voltage across electrolytic cell 12 utilized for electrolyte heating only, separate from electrolysis, may be determined to be the difference between the overall voltage across the cell 12 (5.0 V) reduced by the voltage requirement for electrolysis (1.5 V) for a net heating voltage of 3.5 V utilized for heating the electrolyte. Thus, the corrected wattage input is reduced to 1.7 watts (3.5V x 0.48 Amps). Recalculation for output yield of the electrolytic cell 12 utilizing the revised wattage of 260 watts (W out) provided by the corrected wattage input of 1.7 (W in) x100% produces a further revised yield calculation of 15,294% yield.

In a still further attempt to be more accurate with respect to the true yield calculation, the preferred embodiment of the electrolytic cell 12 shown in FIG. 2 includes a stacked or series array of three separate beds 76, 78 and 80 of electrolytic cells as previously described. These may be viewed as being three separate beds or subcells each having 1.67 volts applied thereacross (5.0V / 3). Assuming 100% electrolysis of the liquid electrolyte across each of the subcells requiring 1.5 volts (theoretical) to effect this complete electrolysis, the net voltage across each of the three beds 76, 78, and 80 is reduced by 1.5 V to 0.167 V available for heating only of the electrolyte 112 as it passes through the cell 12. The wattage calculation based upon this further revised voltage across each of the separate bead beds 76, 78, and 80 produces a net input wattage (W in) of 0.240 watts (3 cells x 0.167 watts x 0.48 amps). Again, revising the yield calculation as described above produces a net yield for the electrolytic cell under the experimental conditions shown in Table I to equal 108, 120% yield (260 W out+0.240 W in x 100%).

This new cell 12 is therefore viewed in one aspect as several individual beds of conductive microspheres or subcells arranged in series. By placing each of these individual subcells within a single housing, the anode of one bead bed becomes the cathode for the next in downstream series. By separating each of the individual bead beds within the system 12 by the porous non-conducting membrane or mesh 84, 88, and 92, electrolysis and heating of the electrolyte takes place beneath or upstream of the respective next in line bead bed thus exposing the electrolyte to the H+ions. Thus, each upstream cell or subcell within the electrolytic cell 12 preheats the electrolyte flowing into the next subcell. The net yield is therefore substantially greater than if only a single cell element were utilized as in the previous '675 and '688 patents.

While the instant invention has been shown and described herein in what are conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention, which is therefore not to be limited to the details disclosed herein, but is to be afforded the full scope of the claims so as to embrace any and all equivalent apparatus and articles.

What is claimed is:

1. A system for electrolysis and heating of a liquid electrolyte comprising:

an electrolytic cell including a non-conductive housinig and an inlet and an outlet;

a first conductive foraminous grid positioned within said housing adjacent to said inlet;

a second conductive foraminous grid positioned within said housing spaced from said first conductive grid and adjacent to said outlet;

a plurality of beds of closely packed conductive microspheres positioned within said housing and extending between said first and second conductive grids in a spaced apart end-to-end arrangement;

each bed of conductive microspheres separated one from another by a foraminous non-conductive mesh disposed across one end thereof and another conductive foraminous grid disposed across another end of each said bed of conductive microspheres;

each of the microspheres of substantially uniform size and density and including:

a conductive metal flash coating of uniform thickness formed by chemical combination with a cation exchange surface of a spherical cross-linked polymer microbead from a metal cation which will chemically reduce with hydrazine;

a metallic hydride forming layer of uniform thickness formed atop said flash coating, said metallic hydride forming layer combining with hydrogen or an isotope of hydrogen during operation to form a metallic hydride;

a metallic support layer of uniform thickness formed atop said metallic hydride forming layer, said support layer having a relatively high hydrogen diffusion rate and a relatively low hydride formation ratio;

means for pumping said liquid electrolyte into said electrolytic cell through said inlet, said electrolyte having a conductive salt in solution with water, said electrolyte exiting from said electrolytic cell through said outlet;

an electric power source having terminals operably connected to said first and second grids.

2. A system as set forth in claim 1, wherein:

said metallic hydride forming layer is taken from the group consisting of:

palladium, lanthanum, praseodymium, cerium, titanium, zirconium, vanadium tantalum, uranium, halfnium and thorium.

3. A system as set forth in claim 1, wherein each said microsphere further includes:

a metallic stabilizer layer of uniform thickness formed atop said support layer, said stabilizer layer being a transition metal capable of a relatively high rate of hydrogen diffusion and a relatively low hydride formation ratio.

4. A system as set forth in claim 3, wherein:

said flash coating is taken from the group consisting of: copper, palladium, nickel and titanium;

said metallic hydride forming layer is taken from the group consisting of: palladium, lanthanum, praseodymium, cerium, titanium, zirconium, vanadium, tantalum, uranium, hafnium and thorium;

said support layer is taken from the group consisting of nickel, gold, silver and titanium; and

said stabilizer layer is taken from the group consisting of: chromium, iron, cobalt and nickel.

5. An electrolytic cell comprising:

a non-conductive housing having an inlet and an outlet;

a first conductive foraminous grid positioned within said housing adjacent to said inlet;

a second conductive foraminous grid positioned within said housing spaced from said first conductive grid and adjacent to said outlet;

a first plurality of conductive- microspheres positioned within said housing in electrical communication with said first conductive grid at a first end thereof and having a first foraminous non-conductive mesh disposed across another end of said first plurality of conductive microspheres;

a second plurality of conductive microspheres positioned within said housing adjacent to said first plurality of conductive microspheres and having a third conductive foraminous grid positioned at one end thereof and which faces said first foraminous non-conductive mesh; disposed across another end of said first plurality of conductive microspheres;

a second plurality of conductive microspheres positioned within said housing adjacent to said first plurality of conduc-

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tive microspheres and having a third conductive foraminous grid positioned at one end thereof and which faces said first foraminous non-conductive mesh;

a second foraminous non-conductive mesh disposed across another end of said second plurality of conductive microspheres and which faces said second conductive foraminous grid;

said plurality of microspheres of substan tially uniform size and density each microsphere including: a conductive metal flash coating of uniform thickness formed by chemical combination with a cation exchange surface of a spherical cross-linked polymer microbead from a metal cation which will chemically reduce with hydrazine;

a metallic hydride forming layer of uniform thickness formed atop said flash coating, said metallic hydride forming layer combining with hydrogen or an isotope of hydrogen during operation to form a metallic hydride; a metallic support layer of uniform thickness formed atop said metallic hydride forming layer, said support layer having a relatively high hydrogen diffusion rate and a relatively low hydride formation ratio.

6. An electrolytic cell as set forth in claim 5, wherein:

said metallic hydride forming layer is taken from the group consisting of: palladium, lanthanum, praseodymium, cerium, titanium, zirconium, vanadium, tantalum, uranium,hafnium and thorium.

7. An electrolytic cell as set forth in claim 5, wherein each said microsphere further includes:

a metallic stabilizer layer of uniform thick ness formed atop said support layer, said stabilizing layer being a transition metal capable of a relatively high rate of hydrogen diffusion and a relatively low hydride formation ratio.

8. An electrolytic cell as set forth in claim 7, wherein:

said flash coating is taken from the group consisting of: copper, palladium, nickel and titanium;

said metallic hydride forming layer is taken from the group consisting of: palladium, lanthanum, praseodymium, cerium, titanium, zirconium, vanadium, tantalum, uranium, hafnium and thori um;

said support layer is taken from the group consisting of: nickel, gold, silver and titanium; and

said stabilizer layer is taken from the group consisting of:chromium, iron, cobalt and nickel.

9. A system for producing useful excess heat in a liquid electrolyte comprising:

an electrolytic cell including a non-conductive housing and an inlet and an outlet;

a first conductive foraminous and positioned within said housing adjacent to said inlet;

a second conductive foraminous grid positioned within said housing spaced from said first conductive grid and adjacent to said outlet;

a first plurality of conductive microspheres positioned within said housing in electrical communication with said first conductive grid at a first end thereof and having a first foraminous non-conductive mesh disposed across another end of said first plurality of conductive microspheres;

a second plurality of conductive micros pheres positioned within said housing adjacent to said first plurality of conductive microspheres and having a third conductive foraminous grid positioned at one end thereof and which faces said first foraminous non-conductive mesh;

a second foraminous non-conductive mesh disposed across another end of said second plurality of conductive microspheres and which faces said second conductive foraminous grid;

said plurality of microspheres each of sub stantially uniform size and density, each microsphere including:

a conductive metal flash coating of uni form thickness formed by chemical combination with a cation exchange surface of a spherical cross-linked polymer microbead from a metal cation which will chemically reduce with hydrazine;

a metallic hydride forming layer of uniform thickness formed atop said flash coating, said metallic hydride forming layer combining with hydrogen or an isotope of hydrogen during operation to form a metallic hydride;

a metallic support layer of uniform thick ness formed atop said metallic hydride forming layer, said support layer having a relatively high hydrogen diffusion rate and a relatively low hydride formation ratio;

means for pumping said liquid electrolyte into said electrolytic cell through said inlet, said electrolyte having a conductive salt in solution with water, said electrolyte exiting from said electrolytic cell through said outlet;

an electric power source having terminals operably connected to said first and second grids.

10. A system as set forth in claim 9, wherein:

said metallic hydride forming layer is taken from the group consisting of: palladium, lanthanum, praseodymium, cerium, titanium, zirconium, vanadium, tantalum, uranium, hafnium and thorium.

11. A system as set forth in claim 9, wherein each said microsphere further includes:

a metallic stabilizer layer of uniform thick ness formed atop said support layer, said stabilizing layer being a transition metal capable of a relatively high rate of hydrogen diffusion and a relatively low hydride formation ratio.

12. A system as set forth in claim 11, wherein:

said flash coating is taken from the group consisting of: copper, palladium, nickel and titanium;

said metallic hydride forming layer is taken from the group consisting of: palladium, lanthanum, praseodymium, cerium, titanium, zirconium, vanadium, tantalum, uranium, hafnium and thorium;

said support layer is taken from the group consisting of: nickel, gold, silver and tita nium; and

said stabilizer layer is taken from the group consisting of: chromium, iron, cobalt and nickel.

13. An electrolytic cell for producing useful excess heating of a liquid electrolyte comprising:

a non-conductive housing having an inlet and an outlet;

a first conductive foraminous grid positioned within said housing adjacent to said inlet;

a second conductive foraminous grid positioned within said housing spaced from said first conductive grid and adjacent to said outlet;

a plurality of beds of closely packed con ductive micro-spheres positioned within said housing and extending between said first and second conductive grids in a spaced apart end-to-end arrangement;

each bed of conductive microspheres separated one from another by a foraminous non-conductive mesh disposed across one end thereof and another conductive foraminous grid disposed across another end of each said bed of conductive microspheres;

said plurality of microspheres each of substantially uni-form size and density and including:

a conductive metal flash coating of uniform thickness formed by chemical combination with a cation exchange surface of a spherical cross-linked polymer microbead from a metal cation which will chemically reduce with hydrazine;

a metallic hydride forming layer of uniform thickness formed atop said flash coating, said metallic hydride forming layer combining with hydrogen or an isotope of hydrogen during operation to form a metallic hydride;

a metallic support layer of uniform thick ness formed atop said metallic hydride forming layer, said support layer having a relatively high hydrogen diffusion rate and a relatively low hydride formation ratio;

means for pumping said electrolyte into said electrolytic cell through said inlet, said electrolyte exiting from said electrolytic cell through said outlet;

said electrolyte including water in solution with a conductive salt;

an electric power source having terminals operably connected to said first and second grids whereby electrical current flows between said first and second grids when said electrolyte is within said electrolytic cell, said electrolyte being heated within said housing.

14. An electrolytic cell as set forth in claim 13. wherein:

said metallic hydride forming layer is taken from the group consisting of: palladium, lanthanum, praseodymium, cerium, tita nium, zirconium, vanadium, tantalum, uranium, hafnium and thorium.

15. An electrolytic cell as set forth in claim 13, wherein each said microsphere further includes:

a metallic stabilizer layer of uniform thick ness formed atop said support layer, said stabilizing layer being a transition metal capable of a relatively high rate of hydrogen diffusion and a relatively low hydride formation ratio.

16. An electrolytic cell as set forth in claim 15, wherein:

said flash coating is taken from the group consisting of: copper, palladium, nickel and titanium;

said metallic hydride forming layer is taken from the group consisting palladium, lanthanum, praseodymium, cerium, titanium, zirconium, vanadium, tantalum, uranium, hafnium and thorium;

said support layer is taken from the group consisting of: nickel, gold, silver and titanium; and

said stabilizer layer is taken from the group consisting of: chromium, iron, cobalt and nickel.

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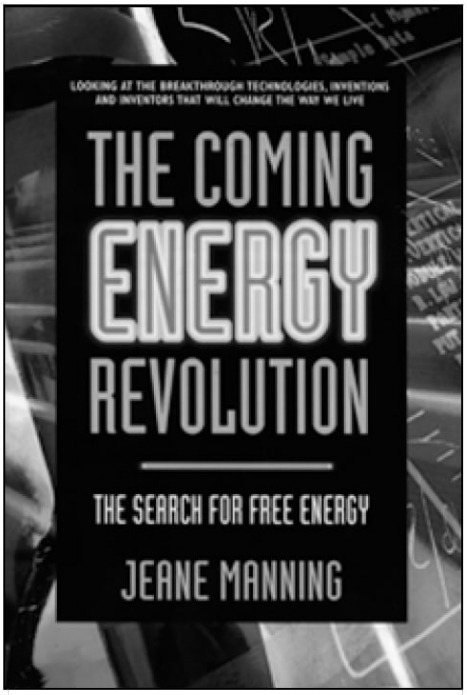

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Editor's Note: Here is something "wild" to tinker with, and you can do it in your kitchen sink or basement— that's for sure! Attempt to reproduce the following claims of Stefan Marinov. Try to find out whether, as one might initially expect, this can't possibly work, or whether this is a brilliant discovery. Ordinarily, we would be disinclined to suggest even attempting a replication of this sort, but Stefan is so brilliant and intense, we trust that you will learn something in your efforts—and *maybe* even confirm an astonishing experiment. Let us learn about your results.—*EFM*
(P.S. Nature magazine rejected Marinov's article. All the more reason to publish it!)

Stefan Marinov

THE SEGNER-MARINOV TURBINE

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A report is given on the first Segner-Marinov turbine constructed on Earth which is a self-accelerating machine. The self-acceleration (production of free energy) is realized by the "tunnel transition" of water under the hydrostatic "potential barrier" of the water lifted by the appearing inertial (centrifugal) forces.

1. THEORY

As we wonder how was it possible that the pre-Columbian American civilizations have not discovered the wheel, so future generations will wonder how was it possible that the pre-1996 world civilizations had not discovered the Segner-Marinov turbine.

I discovered the Segner-Marinov turbine on 3 May 1996. My first reports on phenomenal discovery were published in Refs. 1 and 2.

In this paper I give the report on the first realization of the Segner-Marinov turbine, in which free energy is produced by the action of inertial (centrifugal) forces which lift the water in the turbine without the necessity of spending energy for this lift.

The Segner-Marinov turbine is a combination of two effects which everybody has observed in one's childhood.

The first effect is the so-called Segner's reaction wheel (Segner Reaktionsrad) and the second effect is the so-called Newton's rotating water bucket. One can add that Segner's reaction wheel was discovered by Heron who lived in Alexandria a century B.C., although Ktesibios who lived three centuries B.C. can be named as the authentic discoverer. As a matter of fact, this discovery (i.e. observation) makes any child smart when playing with water, and it is shown in Fig. 1: If a bucket is filled with water and it has at its bottom outlets tangential to the circumference, a torque appears acting on the bucket, because of the jet forces of the water squirting out.

The effect in Newton's rotating water bucket is presented in Fig. 2, and this is discovered (i.e. observed) by any cook when stirring the soup: Because of the centrifugal forces appearing, the stirred soup obtains a paraboloidal form (in the photograph, instead of soup, water has been stirred).

The combination of these two effects, which I call the Segner-Marinov turbine, is shown in Fig.3. This is the technical drawing from which my machinist constructed the first model. It consists of a stationary part which will be called "the pot" and a rotating part which is "the turbine." The diameter of the pot is 180 mm and from here all other sizes can be obtained.

The pot and the turbine are made of PVC (poly-vinyl-chloride) and the turbine's holder, which is fixed to the internal races of two ball-bearings, is made of aluminum. When drawing the diagram I intended to make the pot of two pieces and for this reason one sees in Fig. 3 a rubber O-ring, but later a more clever solution was found by making the pot of a single piece and connecting the two vertical cylindrical holes with the axial tube by two horizontal cylindrical holes bored from left and right which then have been closed by two corks. The dashed lines indicate cylindrical holes bored in the PVC-material which do not cross each other.

Fig.1 (Left)
Fig. 2 (Right)

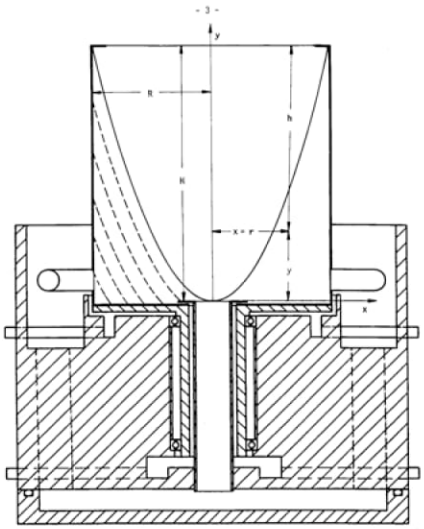

Fig. 3

Continued on Page 68

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CHARGE CLUSTERS IN OPERATION

by Hal Fox, Associate Editor, *Infinite Energy*
Fusion Information Center, PO Box 58369, Salt Lake City, UT 84158-0639

A. INTRODUCTION

Kenneth Shoulders is the world's foremost investigator of high-density charge clusters (HDCC) [1]. First recognized as entities that could be used to design ultra-high-speed computers, HDCC were later found to be useful in energy production. The cited patent [1] is the first patent known to explicitly state that the vacuum energy was being accessed. One important late development is the recognition that much of the excess heat from cold nuclear fusion may be the result of the production of HDCC and the subsequent nuclear reactions [2].

In addition to more than a decade of work by Shoulders in studying charge clusters in low-pressure gas environments, Neal and Gleeson have been working with charge clusters in water solutions since 1994. The first publication of the Neal-Gleeson Process [3] provides information about the use of this discovery for the reduction of radioactivity in radioactive solutions. The recognition that both Shoulders and Neal and Gleeson were creating and utilizing HDCC led to the filing of a patent application as an improvement on the Neal-Gleeson plus Shoulders technology. The label given to this broad use of charge clusters is **Plasma-Injected Transmutation.** The basic technology is discussed in a paper by Fox, Bass, & Jin [4].

The purpose of this article is to present some ideas of the types of nuclear reactions that can be produced by charge clusters and some of the proposed applications for this new technology.

B. ANSWERS TO SOME CHARGE CLUSTER QUESTIONS

1. WHAT IS A CHARGE CLUSTER?

We learned in high school that like charges repel and unlike charges attract. Now we find that electrons, which we would expect to be mutually repelled, can form into a stable charge cluster. A typical charge cluster consists of about one hundred billion electrons that are so dynamic they create electromagnetic forces that keep them together in a small toroid - about one-millionth of a meter in diameter.

Electron charge clusters can pick up positive ions. For example, if a charge cluster is created in hydrogen gas, the cluster will ionize (drive off orbiting electrons) some of the nearby hydrogen and pick up these positive ions. (An ionized hydrogen atom is called a **proton**.) If the charge cluster is created in other gases (or in some liquids) the positive ions that the cluster will pick up will depend on composition of the gas or liquid in which the charge cluster is created. For example, a charge cluster will produce deuterons in a deuterium gas and alpha particles in a helium gas.

Fig. 1 depicts a charge cluster which has been created and has ionized and captured a number of positive ions. A typical charge cluster one micron in diameter will have about 100 billion electrons and have the capability of attracting and carrying about 100 thousand positive ions.

2. WHAT CAN BE DONE WITH A CHARGE CLUSTER?

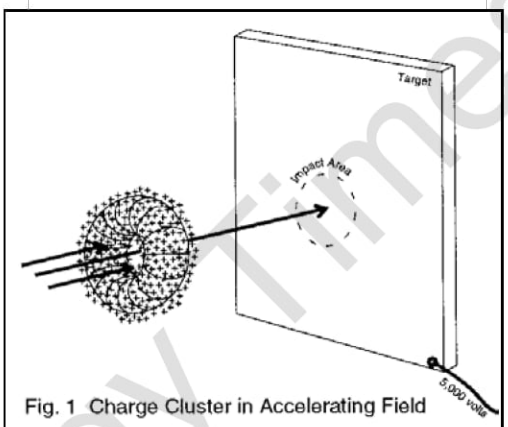

Fig. 1 Charge Cluster in Accelerating Field

The combination of the electrons and the relative few positive ions (about ten positive ions for each one million electrons) can be accelerated in an electric field in the same manner that we accelerate electrons in a TV tube. A five-thousand volt electric field will accelerate the charge cluster to about one-tenth the speed of light. Fig. 1 illustrates a charge cluster **with positive ions** being accelerated in an electric field.

At velocities of one-tenth the speed of light (and at lower velocities) positive ions can cause nuclear reactions. Therefore, if we accelerate the charge cluster and allow or direct the charge cluster to impact a target electrode, we can produce nuclear reactions. Fig. 2 illustrates a charge cluster approaching a target. The intense negative electric field around the charge cluster will repel the ions away from the target nuclei in the vicinity of the impact point, leaving fully ionized target nuclei that have not had time to move. The high velocity of the accompanying positive ions will cause the ions to penetrate the target nuclei producing nuclear reactions.

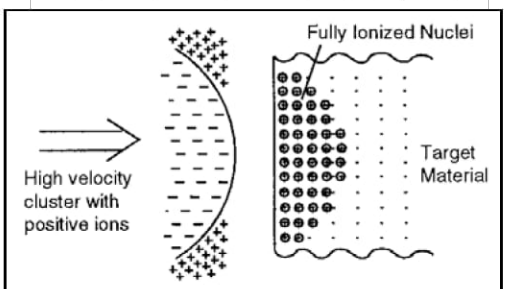

Fig. 2 Charge Cluster Impacting Target

Previously, it has been the common belief of scientists that much higher energies than a mere few thousand volts would be necessary to cause nuclear reactions. So the effect of these electron clusters in picking up positive ions **now gives us a new tool by which we can more easily (and at much less cost) explore the world of nuclear energy.**

3. WHAT KIND OF NUCLEAR REACTIONS CAN A CHARGE CLUSTER CREATE?

The simple answer is **many kinds of nuclear reactions.** We now know how to create charge clusters in low-pressure gases [1], at both atmospheric and higher pressures [5], and in some liquids [4]. We can accomplish the following:

1. We can produce a charge cluster. Let's call it our **Vehicle.**
2. We can add positive ions. Let's call them our **Payload.**
3. We can accelerate the combined cluster. This is our **Accelerating Field.**
4. We can direct the cluster onto a selected anode. Call this our **Target.**

When the **Vehicle** plus its **Payload** is caused to move at a desired velocity by our **Accelerating Field** and impact a **Target** of our choice, we can (with different selections) provide the following types of nuclear reactions:

1. Create thermal energy — heat energy, or
2. Cause heavy radioactive elements to **spontaneously fission**, or
3. Create selected scarce elements from plentiful elements.

4. HOW DOES THE CHARGE CLUSTER OVERCOME THE COULOMB BARRI-

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ER?

It is well known that nuclei of elements have a large positive charge (ignore for the moment that there is not a simple explanation as to why nuclei with many repelling positive charges do not fly apart). When the charge cluster gets close to such a nuclei it will first drive away all of the electrons surrounding the target nuclei. Now the nuclei will have a large net positive charge —**which we call the Coulomb barrier.** Nuclear physicists have discovered that if they can get another element or positively charged nuclei to travel fast enough, then that high-speed positive ion will burst through the Coulomb barrier. **That is what happened with the Payload positive ions on charge clusters. The ions are provided with so much speed that these ions burst through the Coulomb barrier.**

If a charge cluster is created but does not have sufficient velocity, all that occurs is a crash of the cluster onto a target and a burst of energy that melts a small crater in the target material. With sufficient velocity, the charge cluster will carry the positive ions right into the nuclei of the target material and a high-energy nuclear reaction is achieved.

It is well to remember that a nuclear reaction is about **one million times stronger** than a chemical reaction or the thermal reactions that only produce small craters. **Properly formed, properly supplied with a Payload,** properly **accelerated,** and with a suitable **Target** material, a charge cluster can produce **nuclear reactions.**

5. WHY ARE CHARGE CLUSTERS IMPORTANT?

We are poisoning our planet with radioactive materials. **We must clean up this mess.** We are polluting our planet with the burning of fossil fuels. **We must find a better way to produce energy.** We are tearing up much of our planet in search for scarce, but critically-needed elements. We must provide better means for making industrial materials.

Energy conservation is not the answer. New Energy Technology is the answer. **We now have the technology. We need the dedication to apply this technology!**

C. DEVELOPMENT EFFORTS REQUIRED

It is not difficult to create a few charge clusters in low-pressure gases or in a dilute water solution. Charge clusters are stable under certain conditions. Charge clusters are not stable on the surface of a conductor. Therefore, the charge cluster environment must have a certain degree of resistivity to remain stable. Some stability criteria are presented by Jin in his mathematical model of a stable charge cluster [6]. In fact, Jin's model may be extended to explain stability criteria for clusters of various sizes including ball lightning.

Development of charge cluster technology will require methods for creating huge numbers of charge clusters because it requires many micron-size clusters to provide the total effects of creating thermal energy, reducing radioactiviy, or for large-scale transmutation. One development goal is to take the charge cluster developed under water and provide additional energy to the cluster. A recent development at the laboratory in the Fusion Information Center appears to have considerable promise in adding additional energy to charge clusters.

Other technological developments are related to the type of nuclear reactions that can be expected. For example, in using palladium as a target element, and using either protons, deuterons, or alpha particles as the **Payload** on a charge cluster, the question is, "What type of nuclear reactions will occur?" The first step is to determine what type of nuclear reactions are allowed by nature. Any nuclear reaction must obey the conservation rules of energy, baryon number, charge, spin, parity, and isospin [7]. However, it is not sufficient to know that a particular nuclear reaction is possible, **we must learn which reactions are most probable.** To find the answers we must ask Nature by designing and running a large number of experiments.

Some of the experiments we want to pursue are related to the production of thermal energy. In general, many of the nuclear reactions are heat-producing (exothermic) and others require energy to cause the reaction to occur (endothermic). To create abundant, clean, inexpensive thermal energy we want to optimize low-cost exothermic reactions. However, to create scarce elements from plentiful elements, we would expect to have to provide energy to force the desired reaction.

Consider the problem of making scarce elements. Over the millions of years that lightning has struck the earth's surface it is believed that many charge clusters are formed and nuclear reactions have taken place. If we examine a table of the most abundant elements in the earth's surface, we suggest that those elements will be the most likely to be produced by lightning-caused nuclear reactions. However, it is the scarce elements that have not been produced that we want to manufacture by transmutation. Therefore, we are going to have to do a lot of experiments to get to the stage of predicting which **Payloads, Accelerating Field,** and **Target** elements we need to select to get the scarce elements that we require. It is suggested that there will likely be many dozen Ph.D. dissertations that will be produced to answer some of these questions.

D. CONCLUSIONS

In this article a new technology has been described that may become one of the more important energy technologies. In addition, the use of charge cluster technology can be a new window on Nature to discover more about the production of elements and the control of radioactivity. The basic research has been performed. Considerable experimental development is now required to commercialize various aspects of this technology. Charge cluster technology will not be the only viable new-energy technology. There will be other means to produce clean, abundant, low-cost **(but not free)** energy. However, for the reduction and control of nuclear reactions, including handling of high-level radioactive wastes, charge clusters may be the predominant technology of the future. For selective creation of scarce elements (and isotopes of elements) this technology is expected to be predominant.

REFERENCES

[1] Kenneth R. Shoulders, **EV, A Tale of Discovery**, c1987, published and available from the author, P.O. Box 243, Bodega, CA 94922-0243. See also Kenneth R. Shoulders, "Energy Conversion Using High Charge Density," U.S. Patent 5,018,180, issued May 21, 1991.

[2] Ken Shoulders & Steve Shoulders, "Observations on the Role of Charge Clusters in Nuclear Cluster Reactions," *J. of New Energy*, vol 1, no 3, pp 111-121, Fall 1996, 7 refs, 22 figs.

[3] Robert Bass, Rod Neal, Stan Gleeson, & Hal Fox, "Electro-Nuclear Transmutation: LowEnergy Nuclear Reactions in an Electrolytic Cell," *J. of New Energy*, vol 1, no 3, Fall 1996, pp 8187, 6 refs, 1 fig, 1 table.

[4] Hal Fox, Robert W. Bass, Shang-Xian Jin, "Plasma-injected Transmutation," *J. of New Energy*, vol 1, no 3, Fall 1996, pp 222-230, 23 refs, 4 figs.

[5] Nick Reiter & Samuel P. Faile, "Spark Gap Experiments," *New Energy News*, Sept 1996, pp 11 ff.

[6] Shang-Xian Jin & Hal Fox, "Characteristics of High-Density Charge Clusters: A Theoretical Model," *J. of New Energy*, vol 1, no 4, Winter 1996, pp 5-20, 16 refs.

[7] Shang-Xian Jin & Hal Fox, "Possible Palladium-Related Nuclear Reactions," *J. of New Energy*, vol 1, no 3, Fall 1996, pp 192-209, 3 refs.

Note: Those interested in becoming financially involved in furthering the development of this technology should contact Hal Fox at 801-583-6232 or by fax at 801-583-2963.

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PROTONIC CONDUCTORS ARE KEY TO APPROACHING AN UNDERSTANDING OF ANOMALOUS EFFECTS IN THE SOLID/DEUTERIUM SYSTEM

PROTONIC CONDUCTORS AND THE COLD FUSION MYSTERY

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ABSTRACT

New data on the structural analysis of proton conducting ceramics and single crystals indicate that processes of explosive character occur inside samples related to excess heat and neutron yields. The strong pressures in solids, involved in cold fusion studies, were predicted from a series of models (ever so dissimilar), for example, from the initial Fleischmann-Pons paper. This is also in general agreement with our conception of the anomalous effects in protonic conductors and oxide bronzes. The processes resulting in such manifestations, as it is in Bridgman's rheological explosion, can arise in materials which show cold fusion effects. What real phenomena take place, in fact? We believe that such interconnecting factors as the channels of proton transfer, the explosion-like character of processes and the conduction types can be expected to play a crucial role in the anomalous behaviors

1. What has given us proton conducting ceramics to make progress in cold fusion research?

In most experiments and theoretical approaches concerned with so-called cold fusion, excessive attention has been focussed on the palladium samples. But many of the most interesting results in this scientific field were obtained with the use of proton conducting ceramics of Perovskite-related type $ACe_{1-x}d_xO_3$ (where A = Ba or Sr, d = dopant, e g. Nd, Dy, Y, Yb, Gd) covered with a layer of Pd or Pt. The investigation of anomalous effects in such materials was begun in our group in the wake of Fleischmann-Pons' discovery and continues to the present day. Work with similar ceramics is going on in other countries as well, particularly, in Japan in the group of Dr. Mizuno and in the USA by Prof. Oriani. We will consider the most important results presently obtained:

i) Thermal effects. In our work with ceramics the excess heat effects may run, depending on conditions of experience, between 10 and 1000 %. The Mizuno group in Japan published initially about significantly greater output-to-input power ratio, equal to 70,000 (Mizuno et al , 1994). Let us consider the features of calorimetric measurements with ceramics. There are small input currents on the order of hundreds of microamperes or of several milliamperes, and small excess power on the order of some milliwatts appear Secondly, our experiments have been conducted at high temperatures in the region of 400 — 800 °C Thirdly, many results strongly depend on whether current is pulsing or direct. Also, regimes of thermocycling are very important. Under reverse electrolysis loading (with the voltage of 10 or 40 Volts) we observed in a deuterium atmosphere, more heat than for direct [forward direction] current. A spike heat release and heat decay have been observed in some temperature regions. It is interesting to note that in a hydrogen atmosphere we did not observe excess heat with forward-direction current, however small effects of heat release were observed with reversed current. Finally, changes of phase composition and changes of lattice parameters have been observed as well as intense crack formation in the samples, which have shown excess heat effects. In relative magnitude, the thermal effects with ceramics at present seem more preferable, than those with Pd.

ii) Neutrons. The thermal effects are as a rule not correlated with a yield of neutrons, but are related to passage through the points of phase transitions. We emphasize that nonetheless a surprising reproducible agreement in time between heat and neutron effects was observed in one experiment with ceramic (whereupon the sample collapsed into a powder). Until recently, the question of phase transition in the samples based on cerates was still an open question. Conduction studies and heat release measurements (Samgin et al, 1995; Baikov et al., 1995) have given the indications about availability of unknown earlier phase transitions in such ceramics. The availability of phase transitions in undoped barium cerates was established last year also by Raman measurements (Loridant et al, 1995). However the application of these results to cold fusion research presents severe difficulties, because the protonic conduction is related only to doped ceramics.

Of even greater importance is the magnitude of neutron pulse count obtained. In processes of electrolysis in a deuterium atmosphere we observed some events which can be considered in principle as very “sly” electrical hindrance, or as separate neutron bursts of durations of several tens of microseconds (Samgin et al, 1996). We suggest that the latter explanation is valid. Use of modern nuclear electronics in the latest experiments has allowed us to exclude some obvious electromagnetic interferences and other false effects. Thus the yield of neutrons for a certain interval' of time is 2-3 times larger than the maximum significance of background. However, this study did not provide answers to such problem as the origin of these neutrons. We assumed initially, that these neutrons were generated by the usual reactions of D-D-fusion. Other opportunities are now investigated. One possibility is that the neutrons are emitted by any other processes; which are not directly involved in the observable heat excess. One of such variant is the model (Mizuno et al , 1995) that the neutrons in proton conducting ceramics are formed from processes with the participation of third nuclei. As we, this group observed a yield of neutrons (in truth, very weak) with the electrolysis of similar samples in deuterium atmosphere. Note that a radioactivity could he produced as by-product in reactions with such nuclei as these of ceramic cover (e.g. Pd, Pt) or of ceramic constituents (e g. Ce, Y) ,

iii) Tritium, Gamma Radiation, and Helium. The question of their observation in ceramics remains open

iv) Nuclear transmutations. The problem of origin both of nuclear products (neutrons, tritium, helium, gamma) and of nuclear transmutations can be also treated from the common point of view (Mizuno et

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al , 1995) Anomalous radioisotopes (^{197}Pt) were detected in all samples charged with an alternating current of voltages ranging from 5 to 45 V at temperature of 400-700 °C in a deuterium atmosphere. No radioisotopes were found with an atmosphere of hydrogen gas. One can see an analogy with the above-described results with excess heat and neutrons.

v) Neutron anti-effect. New effect (analogous to heat decay) in ceramics, which was named by us the "neutron anti-effect," has been observed. A decay of the neutron count rate into the shielding box with the cell during the passage through the region of phase transitions (Samgin et al , 1996) as well as influence of background on yield of neutrons from the sample of protonic conductor (Lipson et al., 1996: Samgin et al , 1996) have been detected

vi) Structure changes. Structural knowledge is believed to be necessary for the understanding of mechanism of anomalous phenomena. The latest of our investigations show important structural changes in the samples that are responsible for anomalous behaviour (Vakarin-et al., 1995; Vakarin et al , 1996; Samgin et al , 1996)

vii) Crack formation and degradation of samples. The crack formation was clearly observed for all samples which have shown excess heat effect in our experiments (Samgin et al, 1995). Some samples under thermocycling may collapse and furthermore, did not lead to positive results. It should be pointed out that other cases take place when the degradation of sample was visible (e.g. ceramic blackening). We observed also that the reduction of ceramic resulted in a change of conductivity from protonic to pure electronic. This resulted in the simultaneous neutron burst decrease and further cessation of neutron emission (Samgin et al., 1994)

viii) Other protonic and superionic conductors. Anomalous phenomena were also observed in other protonic conductors, for example, by Derjagin's group in Ice and DKDP-type crystals (Lipson et al, 1993). Oxide bronzes are speculated to be good materials for cold fusion (Kaliev et al, 1993; Vakarin et al, 1995; Vakarin et al., 1996). Some perovskite-related ferroelectrics (e.g. $LiNbO_3$, $PbTiO_3$) have also been the subJect of investigation (Fedorovich, 1994). In addition, similar phenomena occur at proton transfer in some biological systems.

We need to known how these effects are related to each other. Which effect causes the manifestation of anomalous phenomena and which is due to its consequences? Which exhibition of a real effect is truly connected with unknown phenomena and which effect could be explained in the frames of known theories (but which are heretofore known to be inapplicable for this purpose)?

2. Ceramics as a model for cold fusion study

We have investigated ceramics, while work in other groups has been conducted for the most part with palladium and titanium. We wanted to test the validity of our cold fusion proposals for the vital role both of the conduction nature and of the layers with different conduction types in the samples.

At about the same time a fracto-acceleration hypothesis was suggested for Pd, which was in good agreement with the transition to semimetallic state in PdH_2 and with the metal-insulator transition (Chechin et al, 1991). We would like to point out one principal feature of the Pd-D system, characteristic also of other crystals used in our experiments. The relevant hydrogen concentrations in a transition metal, such as Pd, can result in appearance of a semiconductor-like regime, that can give rise to dramatic enhancement of the fusion rate (Feng, 1989).

At that time in Ekaterinburg the well-known experiments with neutron generation from oxide bronzes were conducted. The metal behaviors are characteristic of the bronzes in the free state. These experiments were based on some methods of electrochemical treatment of a sample when surface layers with nonmetallic (or semiconductor) properties were produced. With the understanding that bronzes are related to superionic crystals (when ions are transferred along the structural channels), we used samples from high-temperature proton conducting ceramics covered with a metallic layer. Like bronzes, these protonic conductors rank among the same family of materials with ionic conduction. The experiments of Derjagin's group of Moscow with the use of heavy ice, LID and DKDP-monocrystals, resulting in neutron generation, could also be treated as anomalous behaviors of the low-temperature protonic conductors. Note that the problem of chemically assisted neutron reactions has a much longer history then is generally believed. For example, as early as 1969, T. Grant and J. Cobbl reported evidence for chemically bound neutrons from LiF using neutron fluxes. However, this experiment was shown to be faulty (Krohn et al., 1969). In this connection, it is interesting to note that in our work the neutron yields can depend on the background neutron level. What is more, the above-mentioned neutron anti-effect may appear in ceramics and other materials

Certain theoretical models for Pd-D systems seem to be applicable to ceramics. We can demonstrate this with some examples of varied theoretical approaches. There are important benefits to using ceramics.

The information about ceramics suggests an interrelation between anomalous phenomenon and protonic conduction. But the mechanism of protonic conduction in doped $Sr(Ba)CeO_3$-based oxides is also not understood. Numerous data show that a proton is located close to an oxygen site in the lattice and that the proton is transferred between neighboring oxygen ions by hopping assisted by the oxygen sublattice vibrations. Very interesting results have been obtained from the secondary ion mass spectrometry analysis (De Souza et al , 1995). SIMS study using hydrogen isotope implantation in $SrCe_{0.95}Yb_{0.05}O_3$ has shown that the mass/charge ratio distribution in the range m/e=16-19 is strongly distinctive from those obtained for the isotopic ratio of natural oxygen. The authors of this work have proposed that it is possible to identify some anomalous distributions by formations of a new complex such as $^{16}O^1H$. But the identity of the m/e=19 signal cannot be unambiguously determined. In the light of transmutations study in Pd such SIMS study of ceramics is of particular interest.

Quasiparticles will be formed during interactions of protons with the lattice. Their behavior can strongly differ from that of initial protons. A large number of varied protonic conduction mechanism exist. The proton mobility in $SrCeO_3$-based oxides could even be described in the framework of small polaron and exciton soliton theory (Samgin, 1997). In those materials the protonic polarons could be formed, and the conductivity dependencies at high temperatures are in good agreement with those from phonon-assisted hops of protonic polarons. Thus, at high temperature the transfer mechanism is connected with incoherent delocalized proton hops. However, since the proton-phonon coupling is weak, the coherent (tunnel) behaviors should in principle appear in protonic conductors via polaron band. In proton conducting materials the band mobility of deuterons, connected with distinctive phonon mode, could be, in principle, of the same order as hopping mobility. Note, that by its very nature, the small polaron mobility comprises both the contribution of the hopping part and the band part. Only with this quasiparticle, one contribution dominates the other, depending on test parameters for the same sample. In such protonic conductors as $NH_4IO_3{*}2HIO_3$, a transition from proton hopping to band protonic conduction, connected with excitation of high-frequency phonon mode, exists at

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temperature change (but in a low temperature region), when also an abnormal dielectric susceptibility behaviour appears (Krasnogolovets et al, 1993). In protonic conductors, a change of conduction nature can occur at phase transition or may depend on temperature and atmosphere conditions. Anomalous effects have been observed at phase transitions of ferroelectric-ionic conductor type (Lipson et al, 1993)

While on the subject of the nature of conduction, we mean both the type of conduction and its character (e.g. Boltzmann or non-Boltzmann). By way of illustration, let us consider an important example. The advancement of the dynamic theory of protonic conduction shows that in specific cases the cooperative excitations could play a key role in proton transfer. We think that conditions for some non-conventional mechanisms of transfer can be realized, e. g. those of soliton-like excitations connected with energy and charge transfer. It is possible that it is a perfect structure of proton conducting crystals, which affects the cold fusion results, just as is favourable for soliton motion. This has a beneficial effect on initiation of chemically assisted reactions in the lattices. Thus, the problems of conduction nature, energy-charge transfer and cold fusion are intertwined

Note that the mechanism of proton transfer, much like this cooperative motion, is observed in biological structure of the cells (so-called Davydov's solitons or kinks, which can transfer a part of the charge in ice-like structures). Consideration of some quantum mechanical effects shows that a kink-like diffusion front (which can be realized also in the Pd-H system) is favourable to nuclear reactions and gives rise to shock waves in the sample (Fimin, 1996). Our study shows that kink formation may be regarded as a possible transfer mechanism in protonic conductors in some circumstances in which anomalous effects are being generated. This can result in crack formation, in the sample collapse, and in the structural changes seen in the experiments.

It has been known that in protonic conductors there may occur non-reproducible oscillations of “normal” electrical properties, such as resistance, particularly at phase transitions in a hydrogen atmosphere (Loridant et al., 1995). There is reason to touch the non-reproducibility of “abnormal” effects. This is scarcely surprising if we assume a connection with such conduction nature.

We emphasize that several well-known models for Pd-D systems can also be extended to ceramics and can change meaning.

It is pertinent to note the recent spectroscopic data on proton associations in protonic conductors in the context of Takahashi's multibody fusion model for the Pd-deuterium system. The proton traps with radius of 2.6 angstroms have been observed by the quasielastic neutron scattering study of the ceramics of $SrCe_{0.95}Yb_{0.05}H_{0.02}O_{2.985}$ (Hempelmann et al., 1995). The nature of these traps remains unknown. One possibility is that a trap can be connected with proton autolocalization which is a result of strong interaction of protons with the lattice environment. Note that in this situation the diffusion process is very complex and consists of free migration and proton trapping-escape events.

Mention should be made of the possible role of particle traps of various kind in cold fusion. There is a closely approximating behaviour with the formation of regions of deuterium localization near the surface of the samples as a result of the strongly non-equilibrium boundary conditions at non-linear diffusion in Pd-D and ionic conductors (Samgin et al, 1992).

Schwinger was the first to call attention to the fact that the lattice, as a dynamical system, plays a vital role in energy transfer processes. If low energy nuclear reactions occur in fact, the structure features play a large role in the initiation of these reactions. It may be that perfection of conduction channels also plays an additional role as a catalyst and an important constituent of the mechanism of feed-back.

It is well known that the correlated motion of protons in ceramics is connected with the peculiarities of dynamic disorder of a crystal lattice. On the other hand, a structural modification of the ceramic lattice can be produced during a thermal cycle. The phase transitions in the cerates have been poorly investigated. There are some indications on phase transitions in the ceramics at about 450°C (Samgin et al., 1995). Our study has established the orthorhombic structure of the lattice. However, the structural change to other lattice symmetry of perovskite ceramics could be induced by temperature changes (Loridant et al., 1995). This can drastically affect deuteron distribution and splitting of the deuteron positions in ceramics (Samgin et al, 1996), that can be important to the understanding of the role of the lattice. Also in these circumstances, oscillation of electric resistance and fluctuation of the sizes of the domains are known to be evidenced in ceramics. The observed fluctuations of characteristics connected with proton (deuteron) transfer indicate conclusively that the loading of deuterium into the ceramic lattice are fluctuations. This is identical with the basis of a new mechanism for Pd, in which the initial stage can be described as an energy fluctuation within the uniform lattice region, and absorbed energy can initiate a chain reaction as the vibrations of the excited ions bring them into closer proximity (Schwinger, 1994)

There is also considerable opportunity to apply Hagelstein's theory of lattice-induced reactions (Hagelstein, 1996). In passing, it should be mentioned that the essential constituents of ceramics used in our experiments, such as Ce, Nd, Gd, Pt, are Hagelstein's candidate “fuel” isotopes for excess heat production. A change of content of Ce can result also in structural parameter changes which have been observed in experiments with excess heat. This connection with our chemical composition is open to speculation.

3. What is the evidence for processes of explosive character inside the samples?

A change of structure may be associated with a number of factors. The manifestations like the strong pressure or crack formation are predicted also from some non-traditional models. Among other things, the Sapogin quantum theory of cold fusion and energy generation, which explains the excess heat in ceramics, allows for the samples to crack intensively (Sapogin, 1995). This may be attributed to prior treatment of the sample. To illustrate, the electrochemical extraction of sodium from bronzes for the purpose of creation of channel structure in surface layers can also bring into a local reduction of elementary cell volume, because defect in the centre of elementary cell is formed.

Nonetheless, on the basis of X-ray study, we concluded that the processes, occurring inside the samples with which abnormal phenomena were observed, are most likely to be of explosive character and are accompanied by large changes of the crystal structure. Significant reduction of the volume of the elementary cell was established for the ceramics and bronzes, which can be connected with occurrence of strong pressure inside the sample and with its structural reorganization (Vakarin et al, 1996). Bronzes for which neutron emission has been observed have different values of lattice parameter, respectively before and after experience. All the samples for which the neutron generation was not found, have an unchanged volume of the elementary cell— or that volume was found to be increased. All $SrCeO_3$-based ceramics generating heat pulse showed a sharp decrease of the elementary cell volume during the experiment. All the ceramics related to no heat production have one point in common associated with no volume decrease.

There are possibilities for manifestations of shock waves. We discussed this ques-

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tion in connection with solitons. Now we need to focus upon a new case, when in experiences with protonic conductors several conditions closely parallel that in the Bridgman rheological explosion could be realized. This effect can arise at pulsing electrical loading of materials with the voltage of less than 100V and the frequency of about several Hz. These conditions are identical to those, which were executed in our experiments with ceramics when reverse current was used. The Bridgman effect lies in the fact that the insulator phase is ejected from a zone of strong pressure inside the sample (Fateev, 1995). The shock wave initiated by the Bridgman effect resulted in explosion. The possibility of the process occurring spontaneously under strong pressures was implied in the first Fleischmann-Pons paper. In Bridgman's explosion conditions, abnormal behaviour of many reactions could be realized. Specifically, several processes of high energy chemistry operate via the other pathway compared to the normal diffusion and frequently without formation of intermediate product (Enicolopian, et al., 1991).

There is the fact of fundamental importance that in protonic conductors, a structural phase transition (e.g that of ferroelectric-superionic type in $CsDSO_4$ at 412 K) occurs in the field of great strains, which is due to structural modification and which is accompanied by high mobility (Kirpichnikova, 1996). However, all temperature regions with behaviors similar to phase transitions in our experiments with the use of ceramics cannot be viewed with certainly as structural phase transitions.

In our ICCF3-presentation, we pointed out a possible connection between the anomalous phenomena and existence in the samples of the regions with a different type of conduction and with insulator-like properties. The conduction is connected with the high mobility of charge carriers. This mobility is conditioned by certain structural peculiarities, associated both with the conduction channels and electrical properties of the lattice environment. The change of the structure of ceramics and bronzes fixed in our experiments testifies that strong pressures occur. This as the result can be reflected to mobility.

Landau's mechanism of energy dissipation is known. It consists in the fact, that the energy exchange between the wave and ion, which is resonant with this wave, results in considerable cumulative acceleration of ions. It is conceivable that this mechanism manifests itself for deuterons in ceramics, In such a situation, it may be regarded as an added (catalyst) mechanism of the enhancement of deuteron energy to joint action of two or more cold fusion mechanisms. There it is pertinent to note a proximity of processes in the bronze, the ceramic-like sandwich and the ferroelectric.

A similar model of acceleration of deuterons in a wave of specific nature (wave of re-polarization) for ferroelectrics, developed by Fedorovich, is acknowledged to be among the most efficient hypotheses, which can explain neutron generation from nonmetallic crystals. Mechanisms of such type can be applied also for varied proton conducting materials.

4. The importance of the perfection of channel structure in bronzes, ceramics and biological systems to anomalous processes.

Which initial conditions for achieving positive results in a cold fusion experiment are necessary? This is an involved question. Our experiments with the use of protonic conductors show that in the first instance, as appear, we should say the perfection of channel structure of the sample. Under channel structure of substance we understand not only tunnels isolated in the in space (as in bronzes), but also total isolated continuous (let even not rectilinear) way of protonic hops. On one assumption, the generation of neutrons occurs at the moment of the disruption of the channel structure (Vakarin et al, 1995). The prior damage of perfection of the surface layers of oxide bronzes results in absence of the neutron generation. The possibility of such disruption, as egress from ceramic channels to the phase boundary must not be rejected In this case deuterons can interact not onlY with each other, but also with such nuclei as Pt.

On the basis of the present investigation, it is not unreasonable to expect that anomalous biological and geological effects, and nuclear transmutations and other phenomena examined in cold fusion research provide examples of the versatility of the same unknown physical mechanism.

We would like to emphasize the complexity of the performing of correct electrochemical experiments in cold fusion. We can demonstrate this with a simple example. The results can be influenced by the growth regime and the preparation of the sample, by the environment in which experiment is pursued, by the duration of the effect of the test conditions on the sample. For an example, the result was found to be sensitive to a water steam atmosphere. This is due to the fact that the water molecules in surface layers form hydrogen bonds with ions of host oxygen-metal octahedrons in the lattice, deforming them and, accordingly, violating the perfection of the channel structure This could result in the change of physical properties.

Recently, an abnormal behaviour in biological structures was treated alongside the excess heat, the neutrons and nuclear transmutations in such systems as Pd-D or doped ceramics. The Kervran effect (which is known to be connected by analogy with hopping of proton-neutron pairs), his hypothesis of low energy transmutations and its geologic applications to explanations for the change of the composition of minerals will be named first. We should focus our attention also on some biological processes in cells, which are less well known. For example, one way of studying gene mutations is also closely connected with proton transfer in channel cell structure. It has been known also that an approach to the biological mechanism of energy transfer is related to the search for semiconductor properties of albumen There are common traits with the preceding.

However, some of the most interesting parallels are these between above-mentioned influence of radiation background in ceramics and processes proceeding with formations of potential mutations under the effect of low level radiation. These potential mutations are connected with the proton transfer to the neighbouring partner atoms along chain of hydrogen bonds (similar to a chain of OH-bonds in $SrCeO_3$-based ceramics). There a protonic excitor could be formed which may spread in the DNA fragment without scattering, and a local warming connected with the change of the length of H-bonds can exist (Tolpygo et al., 1993). In such systems of nucleatic pairs, as It is known, the role of violation of perfection of the chain is also great. This can be related to the transformation of running wave and to the localization of the energy on the defect in the chain of hydrogen bonds. Thus, general features between potential mutations in DNA and abnormal phenomena (cold fusion) are associated with proton transfer along conduction channels.

Formation of Davydov's solitons is due to the particular properties of some alpha-helix structures, there is also an ideal channel for energy transfer in other biological systems. This conception explains

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also a puzzling case of particular radiation impact on a living organism (Davydov, 1986).

It is interesting to note that for help in understanding of proton transfer in crystals, organic chemistry is of frequent use in the theoretical approach. There is good reason to look at the organic and biological chemistry for guidance in cold fusion understanding.

On the basis of the present investigation, it is not unreasonable to expect that anomalous biological and geological effects, and nuclear transmutations and other phenomena examined in cold fusion research provide examples of the versatility of the same unknown physical mechanism.

REFERENCES

• **Baikov, Yu., Egorov, V.M., Kartenko, N.F., et al.,** 1996, "Calorlmetric study of phase transitions in $BaCeO_3$-based protonic conductors in the temperature range 220-990 K,"*Rus J Techn. Phys. Lett* . 22, 11, 91-94.

• **Chechin, V.A., Tsarev, V. L., Golubnichyi, P. I., et al.,** 1991,"Fracto-acceleration model of cold nuclear fusion," *AIP Conf. Proc.*, 228, AIP, N.Y., USA, 686-690.

• **Davydov, A.S.,** 1986, "Non-linear phenomenon in biology," Problems of Gravitation, Ed.D.Y.Galtsov, Mosoow State Universitv, 95-107.

• **De Souza, R.A., Kilner J.A., Steele, B.C.H,** 1995, "SIMS study of hydrogen in acceptor-doped perovskite oxides," *Solid State Ionics*, 77, 180-184.

• **Enicolopian, N.S., Manevich, ALS., Smirnov, V.V.,** 1991, "Influence of the order of elementary excitations on chemical processes in solids," *Rus. Chem Phys.,* 10, 3, 389-398.

• **Fateev, E G.,** 1995, "Possibilities of establishment of mechanism of neutron generation under mechanical effect on deuterated materials," *Rus. J. Techn. Phys. S. Lett.,* 21, 10, 48-52

• **Fedorovich, G.V.,** "Ferroelectrics for cold fusion," 1994, *Proc. 4th Intern. Conf. on Cold Fuslon*, EPRI, Palo Alto, USA, V4. 30-1 - 30-12.

• **Feng, S.,** 1989. "Enhancement of cold fusion rate by electron polarization in palladium deuterium solid," *Solid State Communications*, 72, 2, 205-209.

• **Fimin, N.N., 1996,** "Quantum interference effects and mechanism of cold fusion," Rus. J. Techn. Phys. Lett., 22, 5, 17-19.

• **Hagelstein, P.,** 1996, "Anomalous energy transfer between nuclei and the lattice," *Progress in New Hydrogen Energy, Proc 6th Intern. Conf. on Cold Fuslon,* Ed M Okamoto, Hokkaido, Japan, Vol. 1. 382-386.

• **Hempelmann, R., Karmonlk, Ch., Matzke, Th. , et al.,** 1995. "Quasielastic neutron scattering study of proton diffusion in $SrCe_{0.95}Yb_{0.05}H_{0.02}O_{2.985}$," *Solid State Ionics*, 77, 152-156.

• **Kaliev, K. L. , Baraboshkin, L N., Samgin, A.L., et al.,** 1993. "Reproduclble nuclear reactions during interaction of deuterium with oxide tungsten bronze," *Physics Letters A*, 172. 199-202.

• **Kirpichnikova, L.F., Polomska, M., Volvak, Ya.,** 1996, "On the peculiarities of the change of domain structure and conduction of crystals $CsDS0_4$ near superionic phase transition," Rus. JETP Lett., 1996, 63, 11, 871-875.

• **Krasnogolovets, V.V., Puchkovskava, G. L., Tarnavsky, Yu.,**1993. "A mechanism of superionic conduction of NH_4IO_3*$2HIO_3$ Crystal," *Rus. J. Chem Phys.*, 12, 7, 973-978.

• **Krohn, V. E , Perlow, G.J , Ringo, G. R., et al.,** 1969, "Search for chemically bound neutrons," *Phys. Rev. Lett.*, 23, 26, 1475-1476

• **Lipson, A.G., Sakov, D.M., Saunin, E. I., et al.,** 1993, "Cold fusion in KD_2PO_4 single crystals induced by the ferroelectric phase transition," *Rus. JETP*, 103, 6, 2142-2153.

• **Lipson, L. G., Kuznetsov, V. A., Sakov. D M., et al.,** 1996, "Cold fusion and electrophysical processes in ferroelectric deuterated crystals: Influence of thermal-neutron background level, D-H substitution and crystal mass," *Progress in New Hydrogen Energy, Proc. 6th Intern. Conf.Cold Fuslon,* Ed. M.Okamoto, Hokkaido, Japan, Vol 2. 512-518.

• **Loridant, S., Abello, L., Siebert, E., et al,** 1995, "Correlations between structural and electrical properties of $BaCeO_3$ studied by coupled in-sltu Raman scattering and impedance spectroscopy," *Solid State Ionics*, 78, 249-258.

• **Mizuno, T., Enyo, M., Akimoto, T., et al.,** "Anomalous heat evolution from $SrCeO_3$-type proton conductors during absorption/
desorptlon of deuterium in alternating electclc field," *Proc. 4th Intern. Conf. on Cold Fuslon,* EPRI. Palo Alto, USA, V2, 14-1- 14-4.

• **Mizuno, T., Inoda, K., Akimoto. T., et al.,** 1995, "Formation of ^{197}Pt radioisotopes in solid state electrolyte treated by high temperature electrolysis in D_2 gas," *Inflnite Energy*, Sept.-Oct., 9-11.

• **Samgin, A. L.,** 1997, "Lattice-assisted protonic conduction in $SrCeO_3$-based oxides: Polaronlc approaches," to be published.

• **Samgin, A.L., Tsidilkovski, V.I., Baraboshkin, L. N.,** 1992, "On the possible formation of regions with high hydrogen isotope concentration at nonlinear diffusion in transition metals," *Abs. 3rd Intern. Conf. on Cold Fuslon,* Nagoya, Japan, 39.

• **Samgin, A. L., Baraboshkin, L. N., Murigin, I.V., et al.,** 1994, "The influence of conductivity on neutron generation process in proton conducting solid electrolytes," *Proc. 4th Intern. Conf. on Cold Fuslon,* EPRI, Palo Alto, USA,V.3, 5-1-5-7.

• **Samgin, A. L., Finodeyev, O.V., Tsvetkov, S.A., et al. ,** 1995, "Cold fusion and anomalous effects in deuteron conductors during non-stationary high-temperature electrolysis," *Proc. 5th Intern Conf. Cold Fuslon,* IMRA Europe, Valbonne, France, 201-208.

• **Samgin, A. L ., Vakarin, S. V. , Andreev, V.S. et al.,** 1996, "Solid Protonic conductors: conductivity, structure, proton traps, phase transitions, excess heat and neutron anti-effect," *Progress in New Hydrogen Energy, Proc. 6th Intern. Conf. on Cold Fuslon,* Ed. M.Okamoto, Hokkaido. Japan. V2, 564-570.

• **Sapogin, L. G.,** 1995, "On one of energy generation mechanism in unitary quantum theory," *Proc. 5th Intern. Conf. on Cold
Fusion,* IMRA Europe, Valbonne, France. 361-366.

• **Schwinger, J.,** 1994, "Cold fusion: does it have a future?," *"Cold Fusion"* (E.F. Mallove, Ed.), 1, 14-17.

• **Tolpygo, K.B.,. Grebneva, E. A.,** 1993, "The dispersion law for the proton exciton in the DNA fragment consisting of guanin-
cytosine pairs," *Ukr. Phys. Rev.,* 38, 3, 355-362.

• **Vakarin. S V , Samgin, A.L., Andreev, V.S., et al.,** 1995, "Influence of perfection of the sodium tungsten bronze single
crystals on neutron emission," *Proc. 5th -Intern Conf. on Cold Fuslon,* IMRA Europe, Valbonne, France, 227-232.

• **Vakarin, S.V. Samgin, A. L. , Andreev, V. S.,** 1996, "Structural changes of single crystals in-neutron generation experiments," Progress in New Hydrogen Energy, Proc 6th Intern. Conf. on Cold Fusion, Ed. M.Okamoto, Hokkaldo, Japan, V.2, 606-609.

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• Segner-Marinov, from page 61.....

The Segner-Marinov turbine functions in the following way:

At rest of the turbine, water is filled in the external ring recipient which via the two vertical holes and the lower cylindrical recipient (which, I repeat, was substituted by two horizontal cylindrical holes) mounts along the axial tube until reaching its upper rim. Then the turbine is set in rotation with a certain rotational velocity Ω and one begins to fill it with water, as shown in Fig. 4. The angular velocity Ω is such that if the turbine has no holes, the rotating water has to form a rotational paraboloid which just has to reach the rim of the turbine, as it is shown in Fig. 3. Because of the action of the centrifugal and hydrostatic pressures, the water in the turbine begins to squirt out from the two outlets (nozzles) in directions tangential to turbine's circumference. The squirted out water immediately via the axial tube

Fig. 4— Segner-Marinov Turbine in operation *(Courtesy, Stefan Marinov)*

streams back into the turbine. We fill the turbine with water until the moment when its paraboloid reaches the upper turbine's rim and the bottom's center. Then we detach the driving electromotor which can be seen in Fig. 4 at right.

If the self-accelerating torque acting on the turbine (which will be calculated in a while) will be equal to the inevitable friction torque, the turbine will rotate eternally. If this driving torque will be larger than the friction torque, the turbine will begin to increase its velocity and water will begin to sprinkle out of its upper rim. If the driving torque will be less than the friction torque, the turbine will begin to decrease its velocity and water will begin to flow out via the space outside of the axial tube.

The calculation of the self-accelerating torque acting on the turbine can be done by any smart college student (Fig. 3):

The radius of the turbine is indicated by R and its height by H. The y-axis is along the axis of the turbine and the x-axis along one of its bottom radii. We shall assume that the radii of the axial tube and of the two nozzles are very small with respect to R and the y-components of the tube's rim and of the nozzles are very small with respect to H. At these simplifying assumptions, water will form a paraboloid with initial point at the center of turbine's bottom.

The coordinates of an arbitrary point in the water are indicated by x=r and by y, and the notation h=H-y is

Continued on page 71

Commentary: An imaginative synthesis of diverse phenomena....

Concerning Production of Elements and Plasmoids

by Edward Lewis

P. O. Box 13050, Chicago, Illinois 60613, June 3, 1996, revised Oct. 10, 1996

In the April 1996 issue of *Fusion Facts*, H. Fox reports[1] about the recent experimental work of Bockris and Minevski and Mizuno et al. It seems that both Bockris and Minevski[2] and Mizuno et al.[3] have reported the production of heavy elements and new elements in a surface layer on their palladium electrode. Bockris commented, "There is suggestive evidence that new nuclei occur in occupied sites within the palladium and that these sites are 'damage areas' consisting of holes in the palladium."[4] Such a phenomenon of voids near the surface which contain new elements is quite similar to results Matsumoto published almost four and a half years ago. I explained such voids according to my plasmoid ideas.[5] In 1991, Matsumoto produced convincing evidence of massive production of many elements and heavy elements in voids in a palladium electrode, and he developed his own "Nattoh"[6] model. I resolved these CF phenomena as plasmoid phenomena like ball lightning, with which idea Matsumoto agrees.

Yet the phenomena Matsumoto produced has been almost totally ignored. According to much evidence, it seems that atoms and particles are plasmoids— as are galaxies and stars[7,8,9,10]. I have developed a working theory about all phenomena as plasmoid phenomena. An understanding of atoms and particles as plasmoids would enable understanding of many anomalous phenomena, such as cold fusion phenomena and the production of elements and atoms.

Plasmoid research goes back decades. Many people have developed similar phenomena and ideas in different areas such as electrical discharge, fusion research, astrophysics, ball lightning research, and general physical theories. W. Bostick produced things he called "plasmoids" by discharging through electrodes. In an article published in 1957 he speculated about the identity of galaxies and particles as "plasmoids."[11] According to A. Peratt[12], Bostick coined the term "plasmoid." This early work led to further experimental research on plasmoids for various purposes. From Bostick's early work, and Alfvén's early work with plasmas, a whole school of plasma astrophysical research has developed. E. Lerner authored a good book about the development of astrophysical plasmoid theories.[13] Plasmoid research also led to some ball lightning research and modeling.

I resolved ball lightning and the tiny objects emitted during the cold fusion process as plasmoid phenomena— developing a general theory about it. The various kinds of plasmoids emitted by the electrolysis and discharge apparatus used by Matsumoto emit tiny plasmoids, which he has photographed leaving several kinds of traces on emulsions.[8] The plasmoids travel though glass, water, and air to get to the emulsions—a behavior like that of ball lightning. Matsumoto has published many pictures of these traces in articles such as the ones referenced here. He accepts the view that he is producing ball lightning-like plasmoids.

I think that atoms are plasmoids that are the sources of that which manifests as electricity or light—atoms may convert to light and/or electricity directly, and light and electricity may convert to atoms. This idea contradicts the basic ideas of conservation of Baryon number, hadrons, nuclear structure, etc. But I think that the evidence for this is simply the documentation of plasmoids emitting atomic particles: such as the one that passed through glass that left the trail and particle traces that Matsumoto calls the "Superstar" (Fig. 8)[14] trace; hollow tunnels left by moving plasmoids and other voids in electrodes and other materials; the recent work with "electron droplets" or "electron clumps" that some researchers

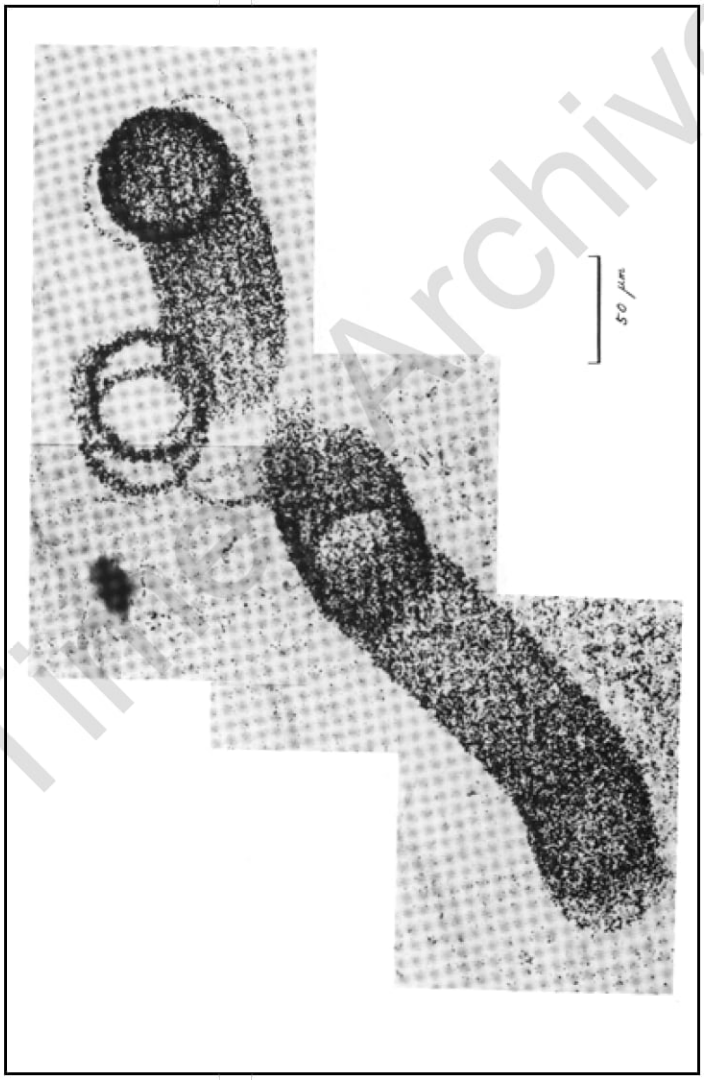

Figure 1: Plasmoid Hopping and Skimming Marks
(From T. Matsumoto, Artificial Ball-Lightning -- Photographs of Cold Fusion, manuscript dated Jan. 17, 1995 presented at the 5th International Conference on Cold Fusion, April 9-13,1995, Monaco.)

A micrometer size ring plasmoid left these marks on a piece of nuclear emulsion that Matsumoto set near an electrical discharge device. He has produced many other traces like these. The plasmoid was produced by electrical discharge in a solution of ordinary water and potassium carbonate using a cadmium electrode. It traveled through water, glass, and air to reach the emulsions.

Traces like these produced by Matsumoto are very important phenomena. This trace is of phenomena that is intermediate between ball lightning, whirlwinds, and plasmoids, and thus is evidence of an identity of all these phenomena. Such micrometer size plasmoids are obviously associated with the "cold fusion" phenomena, and are apparently a locus of the phenomena.

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such as Marc Kastner at MIT are calling "artificial atoms"; and the anomalous atomic production now being reported all over the world. As K. Shoulders wrote to me, "A new binding method for electrons has been found and the old one using a nucleus is passe."[15] There is no longer a reason to think in terms of nuclei as the reason electricity seems to clump as atoms.[16] However, I don't know enough experimental evidence to suggest the structure of atoms or other plasmoids, and I don't know whether plasmoids are usually clumps of electrons or of objects larger than electrons.

I explained two different kinds of holes people find in electrodes: round ones due to plasmoid boring, intergrain or grain-shaped voids that may be lined with new elements, and crystals that are due to the clumping or conversion of plasmoid atoms. Others such as Liaw and Silver[17] have photographed such seemingly anomalous micrometer-size round pits, or they have produced SEM pictures of them. Both Silver and Matsumoto (their Fig. 10)[18] have shown photographs or SEM pictures of micrometer size ditches or trails in their electrodes —similar to the trails on the nuclear emulsions that Matsumoto has shown.

K. Shoulders has reported both pits and tunnels, and ditches or grooves[19] in materials produced by the plasmoids he uses. Both the kinds of voids and the ditches are evidence of the conversion of plasmoid atoms to light and/or electricity and/or other kinds of plasmoids in association with the moving plasmoids.

Interestingly, the new element-filled voids in the electrode that Matsumoto used seem to be "near the surface" or opening on the surface, almost entirely within about 20 micrometers of the surface, most within 10 micrometers. But the voids are quite large, sometimes greater than 8 micrometers in width. In the same way, the voids in the Numata et al.[20] electrode seem to be on and near the surface, in a layer of grains at the surface distinct from the two huge crystals that make up the bulk. I couldn't determine the dimensions from the article. The authors did not perform elemental analysis.

Several groups early on such as Numata et al. compared the electrode phenomena to the earth's earthquakes and volcanoes. The emission of ball lightning-like plasmoids by electrodes is similar to the emission of gorgons[21] from the earth. Gorgons are a kind of plasmoid that behaves like atmospheric ball lightning, but which are emitted by the earth from volcanoes or during earthquakes, or at other times. They are sometimes very long-lived and travel at supersonic speeds. They may be microscopic particles like the ones produced by Matsumoto or huge phenomena more than half a mile long such as the one recently videotaped and shown on *Paranormal Borderlines*.[22] Recently, a video taken about April 1996 of a "white cylinder" that was a half mile long traveling very fast at about 75,000 feet over Colorado was featured on that television show. A similar picture that was taken a little later in another state was also shown. According to reports, the object was luminous and rapidly exhibited a variety of changing colors. It seems to have been layered or somewhat segmented.

Egon Bach has studied this kind of phenomena for many years, and describes many phenomena like this. In Egon Bach's book[23], there is a series of pictures of a long-term semicircular chain of giant gorgons near a volcanic cloud that show that the plasmoid chain did not rotate. This suggests that circular plasmoid chains do not all rotate. Evidence that solid looking ring plasmoids are not in themselves vortices, though they may be associated with moving air or water, is a broken ring trace shown by Matsumoto in Fig. 7 of Ref. 14. The giant plasmoids shown in Bach's book periodically blinked on and off as do other plasmoids. Since, as Bach stated, some ball lightning phenomena are reported to be cool or cold, various types of plasmoids may have both exothermic and endothermic phases.

Ohmori et al.[24] will soon publish an article about the production of elements and heavy elements by electrolysis of ordinary water and gold electrodes. In many ways, this work reminds me of Matsumoto's prior transmutation article. They presented this paper at a meeting on the production of elements that was held in Texas (see *IE* #9); several other experimental papers reporting the production of elements were also presented. So Matsumoto's observation is now being confirmed. Ohmori et al found deposits at the bottom of their glass vessel in which the majority of the elements were new elements: Hg, Pt, Fe, Si, and F. They also found volcano-like structures on their electrodes which look somewhat like volcanoes on the earth. One of them was 20 micrometers wide and 30 micrometers high, though it is evident that the tiny size and differing composition of the tiny structures may be responsible for the novel shapes. However, unlike Matsumoto's procedure, they did not analyze the inner structure of the electrode. So it is suggested that they should cut them open and perform the analysis.

I had been predicting such volcano structures would be discovered in electrodes and various devices. The "volcanoes" are composed of gold and also the elements which were left on the bottom of the device. This suggests to me something akin to that which happens in volcanoes on the earth. There is the production of elements and the moving of substance above the surface forming a cone. There is also the emission of moving plasmoids that may leave new elements as residues in various places such as at the bottom of the cells and the outspewing of substance—similar to the way that lava is thrown up and falls back down on the earth as various kinds of igneous rocks such as pumice or basaltic rocks. I suggest that the various kinds of rocks and minerals that people find in igneous rock formations may be mimicked within various laboratory devices being devised today. I suggest looking for more porous types of "rocks" on the bottom of the devices or dispersed from eruption points. Look for denser deposits or lava flows on the surface of the material near the point of outpouring. Look for crystals of various minerals and elements, perhaps under the volcanolike structures— similar to the zones of crystals under volcanoes or in igneous pipes.

The plasmoid emission of various devices may leave residues unlike that normally thought to be produced in volcanoes, but more like gorgon and ball lightning residues. The residues that were found at the bottom of the volcanoes were porous-like pumice.

It may be that at least some of the crystalline voids found by Matsumoto and shown in his 1991 article led to surface structures similar to volcanoes. The crystalline voids may therefore be similar to those found in igneous pipes and formations.

This element production work and various types of devices producing excess energy or excess current confirms my original ideas about atoms and atomic transformations. I have long thought that atoms are plasmoids. Like plasmoids, they can convert to light and electricity directly, hence my explanation for the CF phenomena, ball lightning, and other anomalies. Atoms may transform to other kinds of atoms, to larger or smaller plasmoids that may move, or directly to electricity and light. If the Correa device works, then it may be that the recent Correa patents may come closest to showing that the lattice of electrodes actually converts to other plasmoids and electrical output—the surges they report. People may find additional electrical output associated with various devices associated with atomic transformations or excess radiation in the form of plasmoid emission such as electrons or electrical current.

I have described trying to apply MHD theory as developed by these physicists

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and astrophysicists to the plasmoid phenomena in superconductors called "superconducting vortices."[25] I suspect that the superconducting aspects of plasmoids, including the ability of even large ones such as ball lightning to travel though insulators such as glass or ceramics without much change to the insulators, is related to the clumping of atoms and other plasmoids. Very small plasmoids such as electrons may clump to form atoms, and atoms may in the same way clump to form larger atoms or larger plasmoids.

Evidence for the production of elements in ring shaped, micrometer sized plasmoid phenomena has been recently reported by Matsumoto[26]. This is evidence that the new elements that people may find in various devices may be due to moving plasmoids. Recently, Matsumoto has shown what may be the best picture of a ball lightning, or at least the best picture of micrometer sized ball lightning, unless it actually is only a effect or residue of a ball lightning. It is ring shaped, as many ball lightning are reported to be, about 9.5 micrometers in diameter, and it is opaque and not apparently luminescent, as some ball lightning also are reported to be. He photographed it on an iron wire electrode by using a micro-telescope and camera equipment. Though ball lightning is usually luminous, Ken Shoulders reported what he calls "black EV" that don't give off visible light, and people have reported seeing black globes[27] that don't radiate light. There are also reports and pictures of ball lightning phenomena blinking on and off, that is, they switch from being luminous to being not luminous.

During electrolysis or electrical discharge or other stress, as during volcanic activity, much substance may convert to light and/ or electricity, and may convert to plasmoids of various types and sizes.

Residues may be found like pumice or lava flows. Plasmoids of various sizes may be emitted and become electrical discharges or light or cause changes far from the site of origin. Voids, cones, or craters may generally be left at the site of the emission of plasmoids. Neutrons, electrons, and other types of plasmoids may be emitted, and new elements and substances may be produced and left as residues.

References:

1. H. Fox, "Implications of the Bockris-Minevski & Mizuno, et al. Papers," *Fusion Facts*, 7 (no. 10), 1 (April 1996).
2. J. O'M Bockris and Z. Minevski, "Two Zones of Impurities Observed After Prolonged Electrolysis of Deuterium on Palladium," *Infinite Energy*, 1 (no. 5 and 6), 67 (1996).
3. T. Mizuno, T. Ohmori, and M. Enyo, "Anomalous Isotopic Distribution in Palladium Cathode after Electrolysis," INET# Document Id:UX00e .BUX0462455.
4. J. O'M Bockris, "Comments From John O'M. Bockris," *Fusion Facts*, 7 (no. 10), 3 (April 1996) .
5. E. Lewis, "Plasmoids and Cold Fusion," *Cold Fusion Times*, 2, no. 1, 4 (Summer 1994).
6. T. Matsumoto, "'Nattoh' Model for Cold Fusion,"*Fusion Technology*, 16, 532 (1989).
7. E. Lewis, "Luminous Tornadoes and Other Plasmoids," *Cold Fusion Times*, 1 (no. 4), 4 (Winter, 1994).
8. E. Lewis, "Some Important Kinds of Plasmoid Traces Produced by 'Cold Fusion' Apparatus," *Fusion Facts*, 6 (no. 8), 16 (February, 1995).
9. E. Lewis, "Plasmoid Phenomena," *New Energy News*, 2 (no. 12), 9 (May 1995).
10. E. Lewis, "Tornadoes and Tiny Plasmoid Phenomena," *New Energy News,* 3 (no. 10), 18 (March, 1996).
11. W. Bostick, "Plasmoids," *Scientific American*, 197, 87 (October 1957).
12. A. Peratt, private correspondence, January 27, 1995.
13. E. Lerner,*The Big Bang Never Happened*, Vintage Books, New York, 1991, 1992.
14. T. Matsumoto, "Observation of Gravity Decays of Multiple-Neutron Nuclei During Cold Fusion," *Fusion Technology*, 22, 164 (Aug. 1992).
15. K. Shoulders, Letter, 10/18/82.
I6. I should note that I understood that the structure of atoms may be the same as that of ball lightning , before I received this letter, after I read his patent. Also, E. Lewis, "A Description of Phenomena According to My Theory and Experiments to Test It," submitted to *Fusion Technology*, December 1992.
17. D. Silver, J. Dash, and P. Keefe, "Surface Topography of a Palladium Cathode After Electrolysis in Heavy Water," *Fusion Technology*, 24, 423 (December 1993).
18. T. Matsumoto, "Experiments of One-Point Cold Fusion," *Fusion Technology*, 24, 332 (Nov. 1993).
19. K. Shoulders, [Energy Conversion Using High Charge Density," Patent Number 5,123,039.
20. H. Numata, R. Takagi, I. Ohno, K. Kawamura, and S. Haruyama, "Neutron Emission and Surface Observation During a Long-Term Evolution of Deuterium on Pd in 0.1 M LiOD," *Proceedings of the II Annual Conference on CF*, T. Bressani et al. editors, Como, Italy, June 29 - July 4, 1991.
2I. E. Lewis, "Gorgons, Tornadoes, and Plasmoid Phenomena," manuscript dated April 28, 1996 submitted to *Fusion Facts* May 1, 1996.
22. Paranormal Borderlines, May 14, 1996.
23. E. Bach, "'UFO's' from the Volcanoes," Hermitage Publishers, Tennafly, NJ, 1 993.
24. T. Ohmori, T. Mizuno, M. Enyo, "Isotopic Distributions of Heavy Metal Elements Produced During the Light Water Electrolysis on Gold Electrode," manuscript article presented at the 2nd Int. Conf. on Low Energy Nuclear Reactions, Texas A & M, College Station, Texas, 10/13/96, published in the proceedings in the *Journal of New Energy*.
25. E. Lewis, "Considerations about Plasmoid Phenomena and Superconductivity Phenomena," manuscript article May 29, 30, 1996.
26. T. Matsumoto, "Artificial Ball-Lightning -- Photographs of Cold Fusion," manuscript dated Jan. 17, 1995 presented at ICCF-5, April 9- 13, 1995, Monte Carlo, Monaco.
27. S. Singer, *The Nature of Ball Lightning*, New York, 1971.

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• **Segner-Marinov, from page 68....**

introduced. The pressure in water at the point x,y, i.e., r,h, will be

$$p = \mu gh + (1/2)\mu\Omega^2 r^2, \qquad (1)$$

where μ (= 1 g/cm^3) is the density of water and g (= 981 cm/sec^2) is the gravitational acceleration.

The first term in (1) is due to the hydrostatic pressure and the second term is due to the kinetic pressure produced by the inertial centrifugal forces. At all points of the surface the pressure is constant and as for x=y=0 we have $P_{surf} = \mu gh$ and for x =R, y=H we have $P_{surf}=(1/2)\mu\Omega^2R^2$, we obtain

$$H = (\Omega^2/2g)R^2 \qquad (2)$$

Thus for the constant of the surface parabola $y=kx^2$ we obtain $k=\Omega^2/2g$. At the left part of the diagram are drawn the parabolas for different constant pressures.

The velocity with which water will squirt out from the nozzles will be (Torricelli)

$$v^2 = 2p_{h=H,\ r=R}/\mu = 2gH + \Omega^2R^2, \qquad (3)$$

and the driving torque, at the simplifying assumption that the volume of water squirting out in 1 sec is 1 cm^3, or that μ is the mass squirting out in a unit of time, will be

$$M_{dr} = R_{\mathbf{m}}v = \mu(2gH + \Omega^2R^2)^{1/2}R \qquad (4)$$

The braking torque, M_{br}, will be generated by the Coriolis forces acting on the water which drops from the axial tube with velocity v =0, but at the periphery of the turbine obtains a velocity v=ΩR.

As the Coriolis acceleration radial velocity v over a disk rotating with an angular velocity Ω is **u** = 2Ω**v**, the torque executed by a mass μ of water moving from the center of the disk to its periphery with a velocity v = R in a second will be

$$M_{br} = \int_0^R r\mu 2\Omega v(dr/R) = 2\mu\Omega \int_0^R r dr = \mu\Omega R^2 \qquad (5)$$

Consequently, the net driving torque will be

$$M_{dr\text{-}net} = M_{dr} - M_{br} = \mu(gH)^{1/2}R(2 - \sqrt{2}) \qquad (6)$$

The free power which the Segner-Marinov turbine will deliver will be

$$P_{seg\text{-}mar} = M_{dr\text{-}net}\Omega = \mu(gH)(2\sqrt{2} - 2) \qquad (7)$$

Hoever, we have to take into account that the velocity of the squirting out water given by formula (3) is with respect to the turbine's cylindrical surface and since the laboratory velocity of the latter is ΩR, the squirting out water will have a laboratory velocity

$$v_{lab} = v - \Omega R = (gH)^{1/2}(2 - \sqrt{2}). \qquad (8)$$

The power of this water can be used to rotate another turbine whose blades will serve as external border of the cylindrical recipient in Fig. 3. This second turbine will be set in rotation opposite to the rotation of the Segner-Marinov turbine. Assuming that the second one is a Pelton turbine which transforms the whole power of the squirting out water into kinetic energy, reducing the water's velocity to zero, we shall have for the power delivered by the Pelton turbine

$$p_{pel} = (1/2)\mu v^2_{lab} = \mu gH(3 - 2\sqrt{2}) \qquad (9)$$

Thus the whole free power which will be produced will be, from equations (7) and (9),

$$P_{net} = P_{seg\text{-}mar} + P_{pelt} = \mu gH, \qquad (10)$$

Experiment.....Continued back on page 47

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